SOIL SURVEY OF

Borden County, Texas

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Texas Agricultural Experiment Station

Major fieldwork for this soil survey was done in the period 1966–69. Soil names and descriptions were approved in 1970. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1970. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Upper Colorado Soil and Water Conservation District.

Copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Borden County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and the range sites.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Ranchers and others can find, under "Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect the choice of sites for recreational areas in the section "Recreation."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Borden County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "General Nature of the County."

Cover: Antelope, which now number about 600 in the county, are protected in some wildlife areas. Soil in this area is Olton clay loam, 0 to 1 percent slopes.

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SOIL SURVEY OF BORDEN COUNTY, TEXAS

BY MARVIN L. DIXON, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE,
IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION

BORDEN COUNTY is in the southwestern part of the Rolling Plains and the southern part of the High Plains of Texas (fig. 1). The total area is about 584,960 acres. Gail, the county seat, has a population of about 200.

The climate of Borden County is warm-temperate and subtropical. The average annual rainfall is 17.37 inches.

Borden County slopes gradually from west to east. Elevation ranges from about 2,400 feet in the southeast corner of the county to 3,000 feet in the northwest corner. The drainage is dominantly eastward, through Bull Creek, Tobacco Creek, and the Colorado River.

Most of the county is used for range. The main livestock in the county is cattle.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Borden County, where they are located, and how they can be used. The soil scientists went into the county knowing they were likely to find many soils they had already seen and perhaps some they had not. As they traveled over the county, they observed the steepness, length, and shape of slopes, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

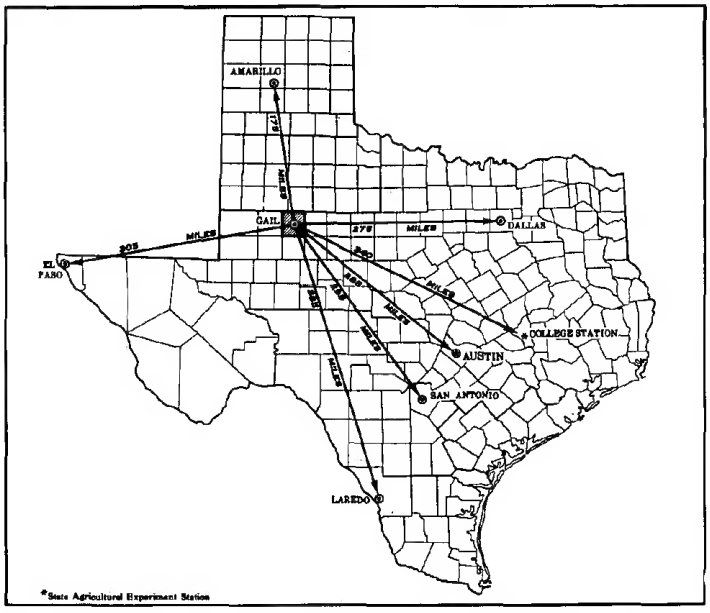

Figure 1.—**Location of Borden County in Texas.**

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all of the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Amarillo and Latom, for example, are the names of two soil series. All of the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Stamford clay, 0 to 1 percent slopes, is one of several phases within the Stamford series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show rangeland, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from these aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping unit are shown on the soil map of Borden County: the complex and the undifferentiated group.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils joined by a hyphen. Rowena-Rotan complex, 0 to 1 percent slopes, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually, but they are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. Colorado and Spur soils is an undifferentiated group in this county.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Rough broken land is a land type in Borden County.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all soils.

Soil scientists then observe how soils behave when used as a growing place for native and cultivated plants and as material, foundations, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil and relate this failure to the slow permeability of the soil or a high water table; or they see that streets, road pavements, and foundations for houses are cracked on a given kind of soil and relate this failure to the high shrink-swell potential of the soil material. In this manner, soil scientists use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential use.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others; then they adjust the groups according to the results of their studies and consultations. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Borden County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed or a wildlife area or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Borden County are discussed in the following pages.

1. Vernon-Weymouth-Stamford association

Moderately deep to deep soils that are clay or clay loam throughout

This association consists of nearly level to steep soils on uplands (fig. 2).

This association includes large areas of the rangeland of the county.

This association occupies about 34 percent of the county. Vernon soils make up about 40 percent of the association, Weymouth soils 15 percent, Stamford soils 15 percent, and minor soils the remaining 30 percent.

Vernon soils are gently sloping on narrow ridges and hilltops and steep on side slopes of natural drainageways. They have a surface layer of reddish-brown clay about 6 inches thick. The next layer is reddish-brown clay about 17 inches thick. The underlying material, which reaches to a depth of 60 inches, is red clay.

Weymouth soils are gently sloping soils on ridges and along natural drainageways. They have a surface layer of reddish-brown clay loam about 8 inches thick. The next layer is about 28 inches thick. It is yellowish-red clay loam in the upper part and reddish-yellow clay loam in the lower part. The underlying material, which reaches a depth of 60 inches, is red clay.

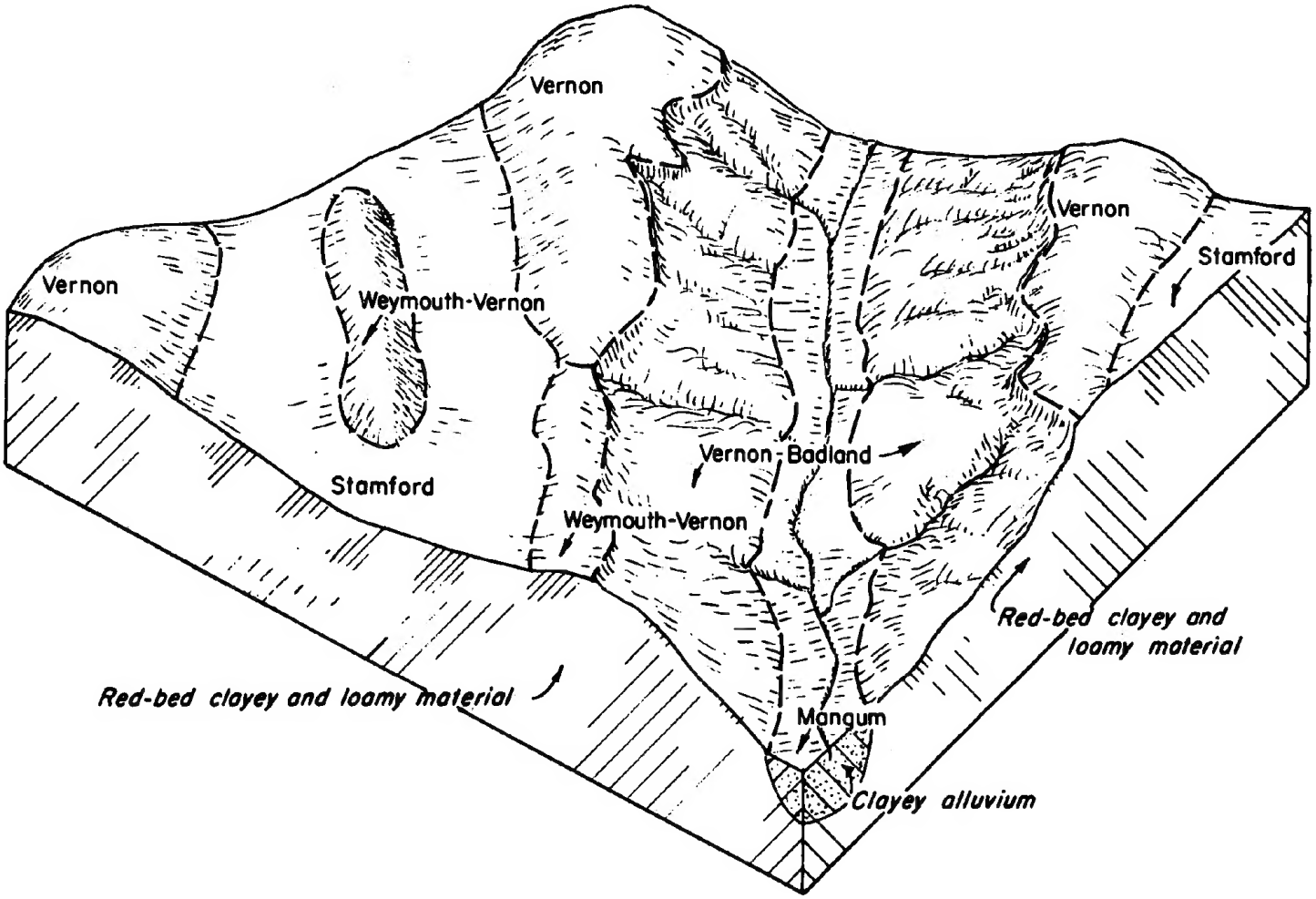

Figure 2—**Pattern of soils and underlying material in association 1.**

Stamford soils are nearly level to gently sloping. They have a surface layer of reddish-brown clay about 7 inches thick. The next layer is reddish-brown clay about 21 inches thick. The underlying material, which reaches a depth of 36 inches, is red clay.

Minor soils in the association are Badland and Colorado, Latom, Mangum, Olton, Polar, Potter, Spade, and Spur soils.

Most of this association is used for range. A few small areas are used for crops.

2. *Olton-Rowena-Rotan association*

Deep soils that have a clay loam surface layer over clay

This association consists of broad areas of nearly level to gently sloping soils. These soils are on uplands (fig. 3).

This association occupies about 23 percent of the county. Olton soils make up about 64 percent of the association, Rowena soils 6 percent, Rotan soils 3 percent, and minor soils the remaining 27 percent.

Olton soils have a surface layer of brown clay loam about 7 inches thick. The next layer extends to a depth of 88 inches. This layer is reddish-brown clay loam to clay in the upper 22 inches, and the lower 59 inches is clay loam that is yellowish red in the upper part and reddish yellow in the lower part.

Rowena soils have a surface layer of dark grayish-brown clay loam about 7 inches thick. The next layer is clay that extends to a depth of 36 inches. It is dark grayish brown in the upper part and dark brown in the lower part. The underlying material, which extends to a depth of 80 inches, is clay loam that is pink in the upper part and reddish yellow in the lower part.

Rotan soils have a surface layer of dark grayish-brown clay loam about 8 inches thick. The next layer, in sequence from the top, is 10 inches of very dark grayish-brown silty clay loam; 24 inches of clay that is dark grayish brown in the upper part and dark brown in the lower part; and 38 inches of silty clay loam that is pink in the upper part and reddish yellow in the lower part.

Minor soils in this association are in the Acuff, Estacado, Posey, Stamford, Lofton, Lipan, Stegall, Slaughter, Latom, Spur, Colorado, Weymouth, and Vernon series.

Most of this association is used for range. A few small areas are used for crops.

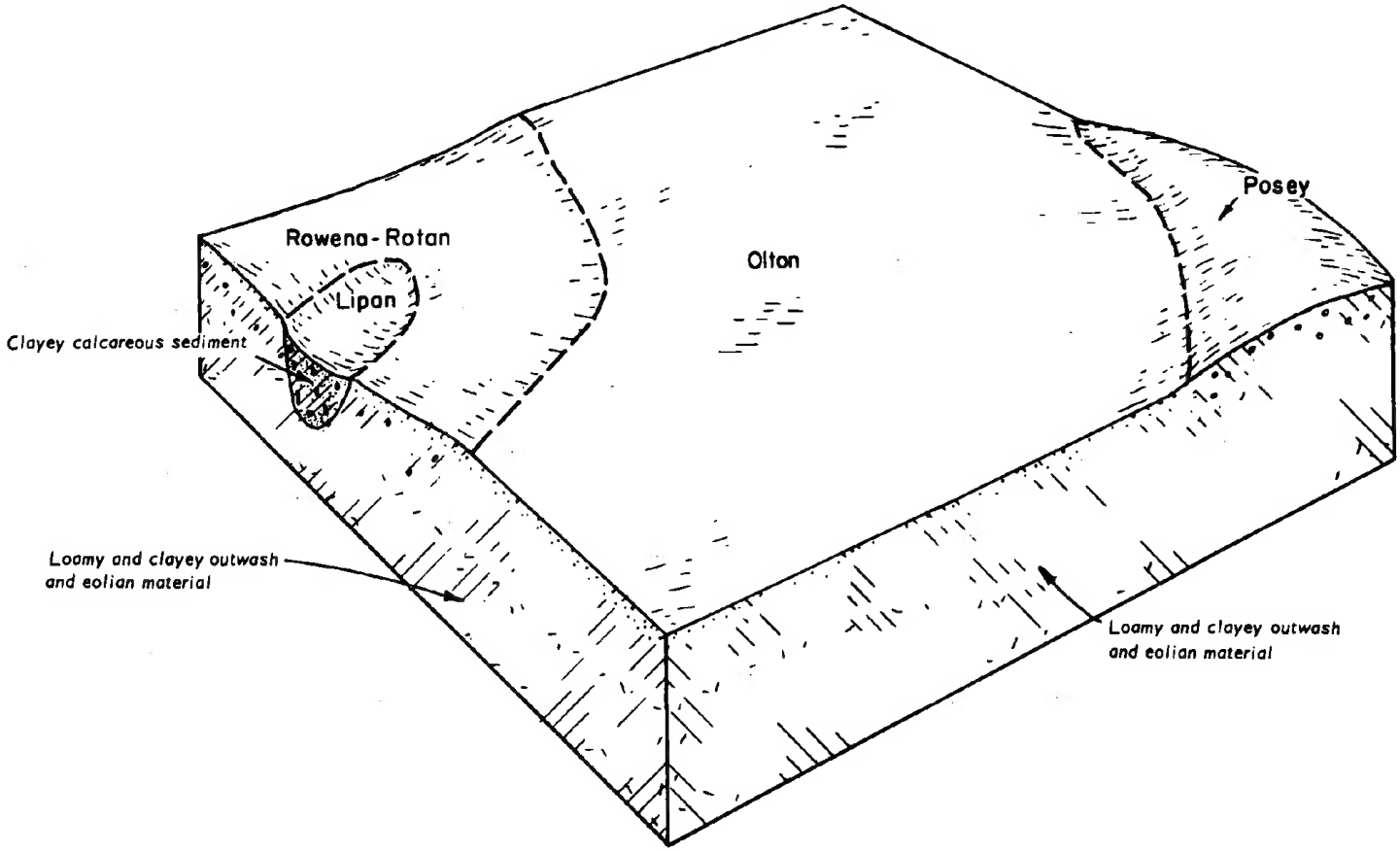

Figure 3.—**Pattern of soils and underlying material in association 2.**

3. *Estacado-Acuff association*

Deep soils that have a loam or clay loam surface layer over clay loam or sandy clay loam

This association consists of broad areas of nearly level to gently sloping soils (fig. 4).

This association occupies about 19 percent of the county. Estacado soils make up about 42 percent of the association, Acuff soils about 40 percent, and minor soils the remaining 18 percent.

Estacado soils have a surface layer of dark-brown clay loam about 14 inches thick. The next layer is clay loam about 66 inches thick. It is reddish brown in the upper 14 inches, pink in the next 28 inches, and reddish yellow in the lower 24 inches.

Acuff soils have a surface layer of brown loam about 7 inches thick. The next layer is sandy clay loam about 73 inches thick. In sequence from the top, the upper 19 inches is reddish brown, the next 9 inches is yellowish red, and the remaining 45 inches is pink in the upper part and yellowish red in the lower part.

Minor soils in this association are in the Olton, Rowena, Patricia, Weymouth, Sharvana, Amarillo, Bippus, Colorado, Spur, Lofton, Rotan, Lipan, and Posey series.

Most of this association is used for range. A few areas are used for crops.

4. *Potter-Posey association*

Very shallow to deep soils that have a loam surface layer over caliche or clay loam

This association consists of gently sloping to steep Potter soils and gently sloping Posey soils. These soils make up a large part of the rangeland in the county (fig. 5).

This association occupies about 9 percent of the county. Potter soils make up about 53 percent of the association, Posey soils about 29 percent, and minor soils the remaining 18 percent.

Potter soils have a surface layer of pale-brown loam about 6 inches thick. The surface layer is underlain by weakly cemented caliche.

Posey soils have a surface layer of brown loam about 9 inches thick. The next layer is clay loam about 37 inches thick. It is brown in the upper part and pink in the lower part. The underlying material, which reaches a depth of 80 inches, is reddish-yellow clay loam.

Minor soils in this association are in the Colorado, Spur, Spade, Veal, Vernon, Olton, Berda, Latom, and Estacado series.

Most of this association is used for range. A few areas are used for crops.

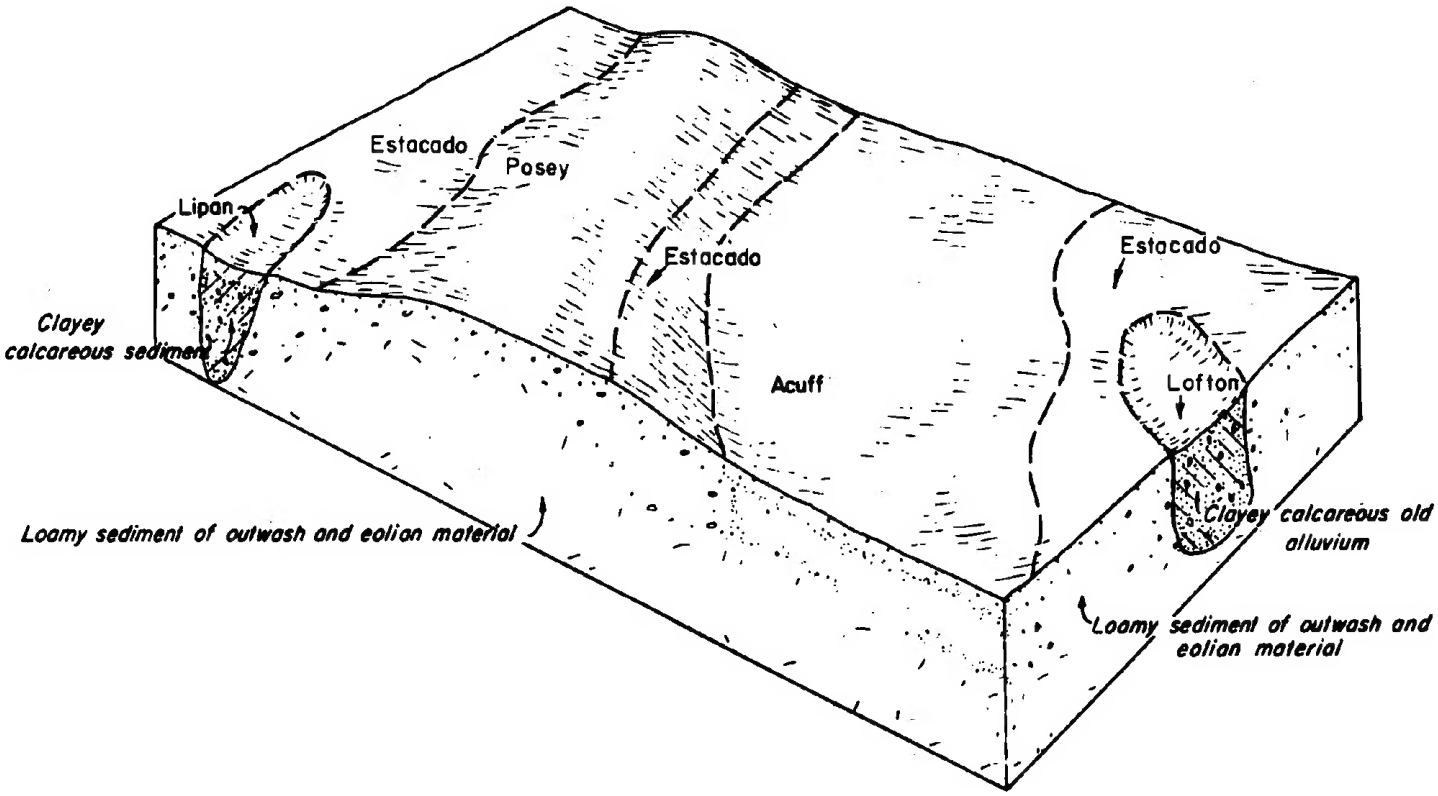

Figure 4.—**Pattern of soils and underlying material in association 3.**

5. *Patricia-Veal association*

Deep soils that have a fine sandy loam surface layer over sandy clay loam

This association consists of broad areas of nearly level to gently sloping and gently undulating soils (fig. 6).

This association occupies about 7 percent of the county. Patricia soils make up about 50 percent of the association, Veal soils 18 percent, and minor soils the remaining 32 percent.

Patricia soils have a surface layer of brown fine sandy loam about 8 inches thick. The next layer is sandy clay loam that reaches to a depth of 84 inches. It is reddish brown in the upper 7 inches, yellowish red in the next 29 inches, and reddish yellow in the lower 40 inches.

Veal soils are on ridges within areas of Patricia soils and along the side slopes of natural drainageways. They have a surface layer of brown fine sandy loam about 7 inches thick. The next layer extends to a depth of 66 inches. It is light-brown sandy clay loam in the upper 11 inches and pink sandy clay loam in the lower 48 inches.

Minor soils in this association are Posey, Latom, Olton, Spade, Potter, Brownfield, Amarillo, and Acuff soils, and Patricia loamy fine sand.

About half of the area of this association is cultivated, and about half is in range.

6. *Berda-Routh broken land association*

Deep soils that have a loam surface layer over clay loam; and Rough broken land

This association consists of gently sloping Berda soils and areas of steep to very steep Rough broken land (fig. 7).

This association occupies about 6 percent of the county. Berda soils make up about 50 percent of the association, Rough broken land about 46 percent, and minor soils the remaining 4 percent.

Berda soils have a surface layer of grayish-brown loam about 11 inches thick. The next layer, which extends to a depth of 48 inches, is pale-brown loam in the upper part and light yellowish-brown clay loam in the lower part. The underlying material is pink clay loam that reaches a depth of 84 inches.

Rough broken land occurs along the escarpments.

Minor soils in this association are in the Bippus, Kimbrough, Weymouth, and Vernon series.

This association is used for range.

7. *Kimbrough association*

Shallow to very shallow soils that have a loam surface layer over indurated caliche

This association consists of gently sloping to sloping soils on uplands.

This association occupies about 2 percent of the county. Kimbrough soils make about 85 percent of the association, and minor soils the remaining 15 percent.

Kimbrough soils have a surface layer of dark gray-

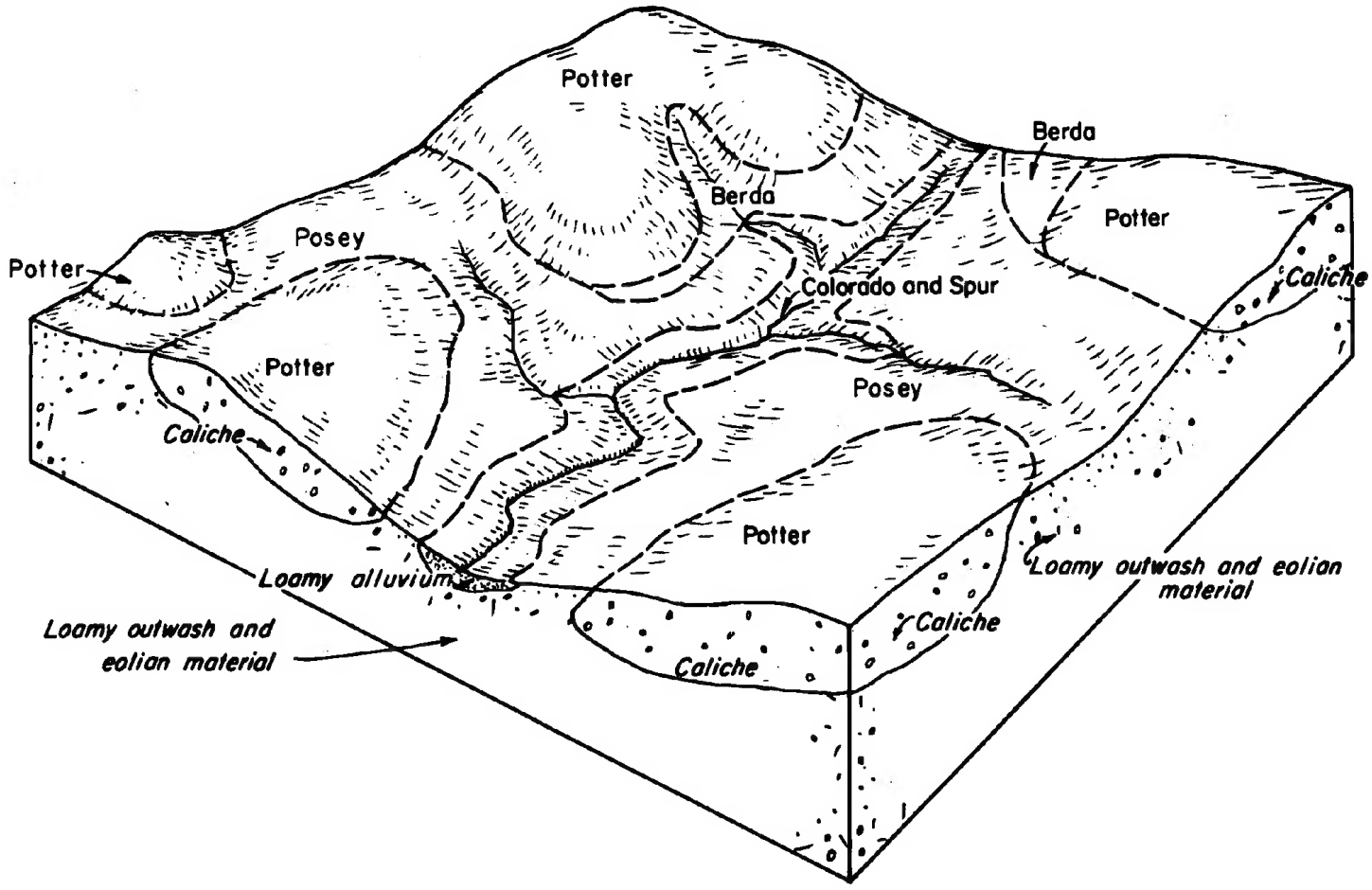

Figure 5.—**Pattern of soils and underlying material in association 4.**

ish-brown loam about 8 inches thick. The surface layer is underlain by indurated platy caliche.

Minor soils in this association are Slaughter, Stegall, Olton, Lipan, and Estacado soils and Rough broken land.

This association is used for range.

Descriptions of the Soils

In this section the soil series and mapping units in Borden County are described. Each soil series is described in detail, and each mapping unit in that soil series is described briefly. It is to be assumed that statements about the soil series apply to the mapping units in that series as well, unless specifically mentioned otherwise. Thus, to find the full information about any one mapping unit, it is necessary to read the descriptions of both the mapping unit and the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, which is the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is more detailed and is for the use of those who need to make thorough and precise studies of soils. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit differs from the profile described for the series, these differences are stated in describing the mapping unit or the differences are apparent in the name of the mapping unit. Color terms are for dry soil, unless otherwise stated.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. For example, Badland and Rough broken land do not belong to a soil series, but, nevertheless, they are listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol, in parentheses, that identifies the mapping unit on the detailed soil map. The capability unit and range site in which the mapping unit has been placed are listed after the description of each mapping unit. The pages on which the description of each capability unit and range site appears can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The approximate acreage and proportionate extent

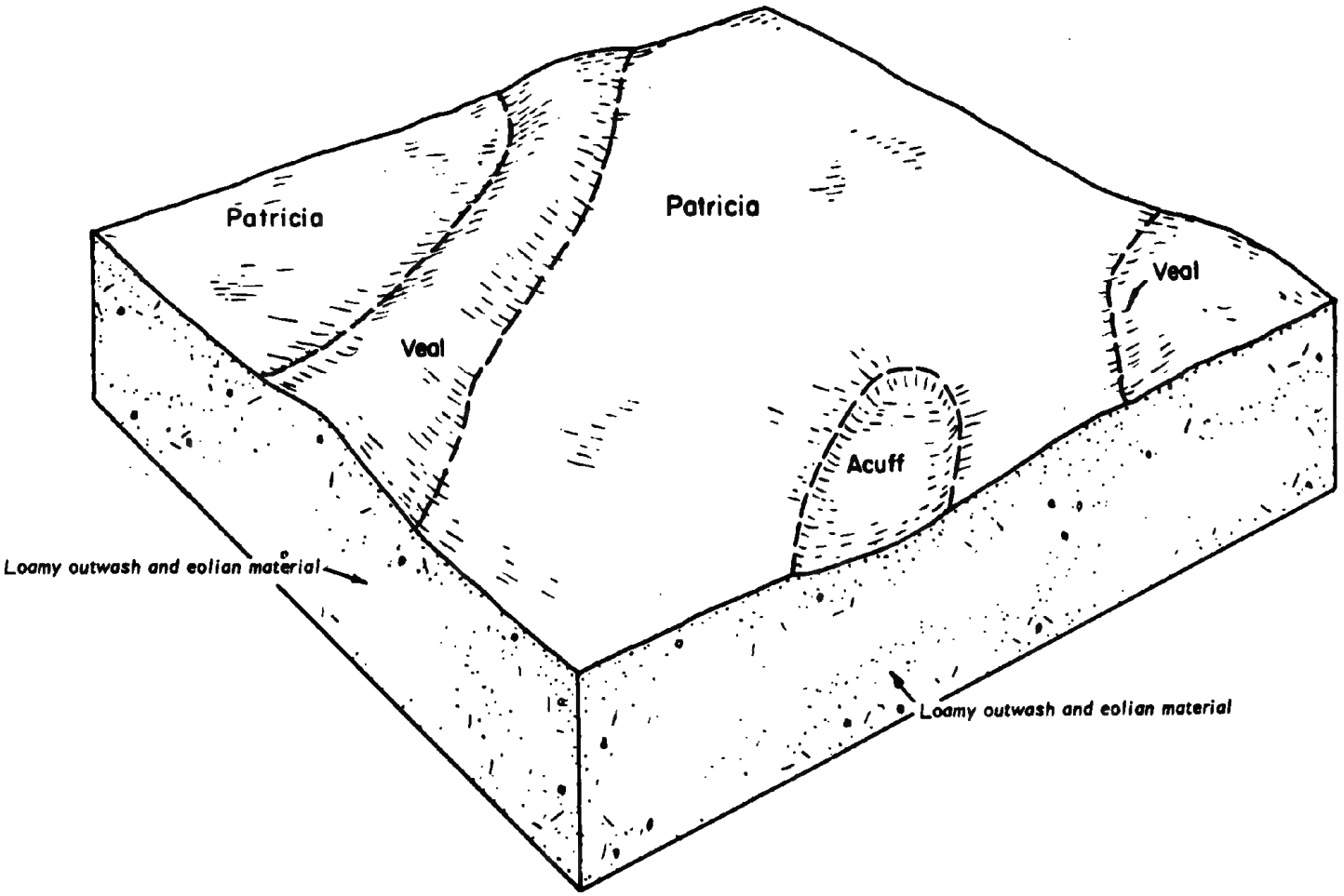

Figure 6.—**Pattern of soils and underlying material in association 5.**

of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*6*) [1]

Acuff Series

The Acuff series consists of deep, nearly level to gently sloping soils on uplands. These soils formed in friable loamy outwash and eolian material.

In a representative profile the surface layer is brown loam about 7 inches thick. The next layer is friable sandy clay loam that extends to a depth of 80 inches. The upper 19 inches is reddish brown, the next 9 inches is yellowish red, and the lower 45 inches is pink in the upper part and yellowish red in the lower part and contains soft masses and weakly cemented concretions of calcium carbonate. The visible content of these concretions ranges from 25 to 45 percent.

These soils are well drained. Runoff is slow. Internal drainage is medium. Permeability is moderate. The hazard of soil blowing is slight. The hazard of water erosion is slight to moderate.

Representative profile of Acuff loam, 0 to 1 percent slopes, in a pasture, 0.4 mile east of a county road from a point approximately 12.5 miles west of Gail, on U.S. Highway 180, 9 miles south on county road:

A1—0 to 7 inches, brown (7.5YR 4/3) loam, dark brown (7.5YR 3/3) when moist; weak, fine, subangular blocky structure; hard, friable, slightly sticky; many fine roots and pores; neutral; clear, smooth boundary.

B21t—7 to 17 inches, reddish-brown (5YR 4/3) sandy clay loam, dark reddish brown (5YR 3/3) when moist; weak, coarse, prismatic structure parting to moderate, fine, subangular blocky; hard, friable, sticky; many fine roots and pores; few thin clay films; neutral; gradual, smooth boundary.

B22t—17 to 26 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) when moist; weak, coarse, prismatic structure parting to moderate, fine to medium, subangular blocky; very hard, friable, sticky; common fine pores; thin clay films; mildly alkaline; gradual, smooth boundary.

B23t—26 to 35 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; weak, coarse, prismatic structure parting to weak, fine, subangular blocky; hard, friable, sticky; few films and threads, weakly cemented concretions, and

[1] Italic numbers in parentheses refer to Literature Cited, p. 65.

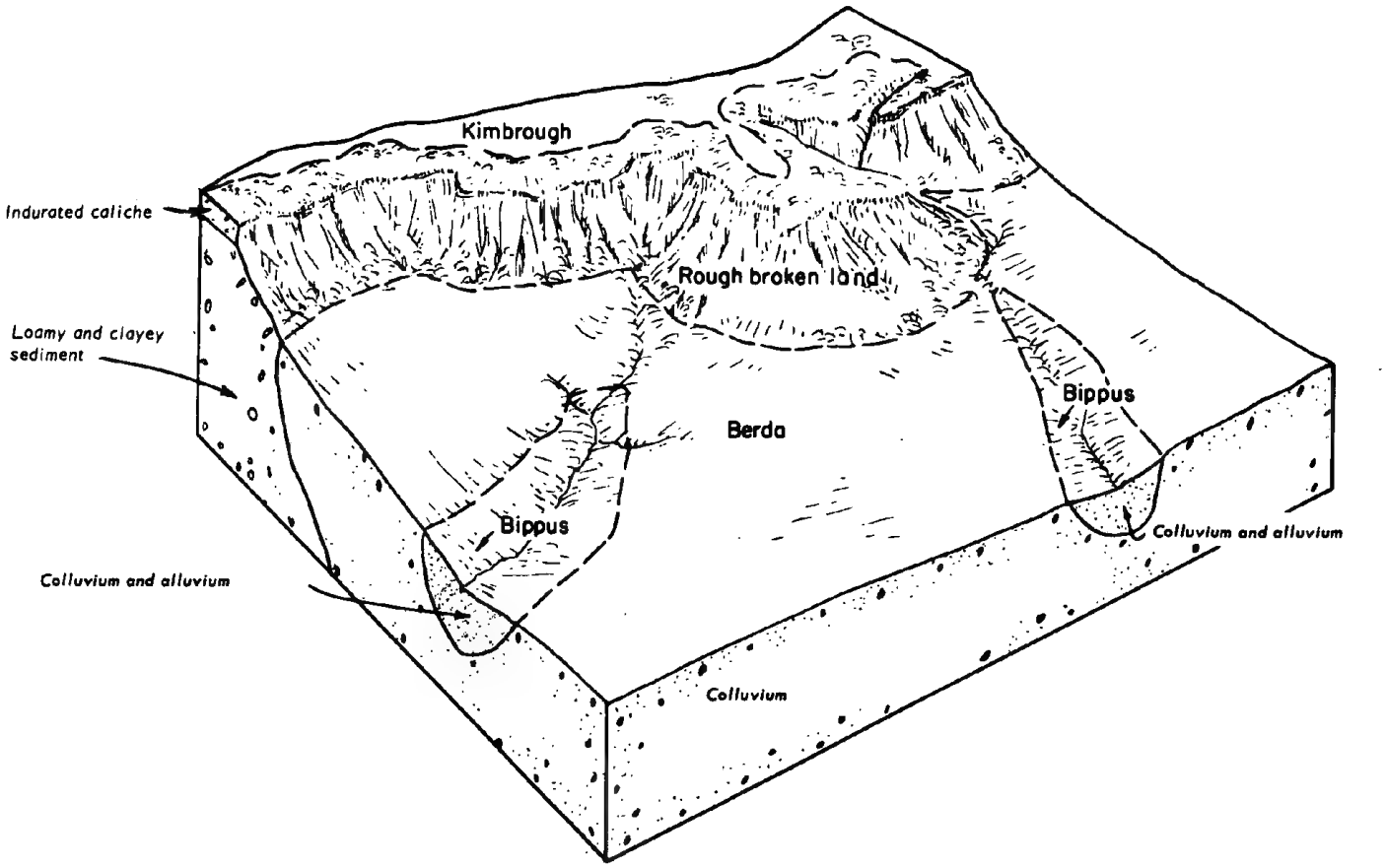

Figure 7.—**Pattern of soils and underlying material in association 6.**

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soils	Acres	Percent	Soils	Acres	Percent
Acuff loam, 0 to 1 percent slopes	21,380	3.7	Patricia fine sandy loam, 1 to 3 percent slopes	21,618	3.7
Acuff loam, 1 to 3 percent slopes	23,380	4.0	Polar soils	1,164	.2
Amarillo fine sandy loam, 0 to 1 percent slopes	318	.1	Posey loam, 1 to 3 percent slopes	19,385	3.3
Amarillo fine sandy loam, 1 to 3 percent slopes	1,450	.2	Posey loam, 3 to 5 percent slopes	718	.1
Amarillo fine sandy loam, 3 to 5 percent slopes	914	.2	Potter soils	31,100	5.3
Arch loam, 0 to 3 percent slopes	646	.1	Rough broken land	16,734	2.9
Badland	1,977	.3	Rowena-Rotan complex, 0 to 1 percent slopes	13,116	2.2
Berda loam, 1 to 3 percent slopes	14,536	2.5	Rowena-Rotan complex, 1 to 3 percent slopes	532	.1
Berda loam, 3 to 5 percent slopes	4,101	.7	Sharvana fine sandy loam, 0 to 3 percent slopes	512	.1
Bippus clay loam, 0 to 1 percent slopes	440	.1	Spade-Latom complex, 2 to 5 percent slopes	7,737	1.3
Bippus clay loam, 1 to 3 percent slopes	745	.1	Spur clay loam	7,452	1.3
Brownfield fine sand	2,479	.4	Stamford clay, 0 to 1 percent slopes	12,604	2.2
Colorado and Spur soils	37,784	6.5	Stamford clay, 1 to 3 percent slopes	19,508	3.3
Estacado clay loam, 0 to 1 percent slopes	39,927	6.8	Stegall-Slaughter complex, 0 to 1 percent slopes	2,709	.5
Estacado clay loam, 1 to 3 percent slopes	7,125	1.2	Veal fine sandy loam, 1 to 3 percent slopes	7,742	1.3
Kimbrough soils	10,098	1.7	Veal fine sandy loam, 3 to 5 percent slopes	1,348	.2
Latom soils	3,189	.5	Veal-Potter complex, 1 to 8 percent slopes	4,497	.8
Lipan clay	3,430	.6	Vernon clay, 1 to 3 percent slopes	24,940	4.3
Lofton clay loam	2,200	.4	Vernon clay, 3 to 12 percent slopes	14,944	2.6
Mangum clay	4,371	.7	Vernon-Badland complex	19,854	3.4
Mangum clay, channeled	12,351	2.1	Vernon-Potter complex, 2 to 30 percent slopes	11,973	2.0
Mobeetie fine sandy loam, 1 to 3 percent slopes	809	.1	Weymouth-Vernon complex, 1 to 3 percent slopes	55,103	9.4
Olton clay loam, 0 to 1 percent slopes	51,804	8.9	Water	4,480	.8
Olton clay loam, 1 to 3 percent slopes	38,421	6.6			
Patricia loamy fine sand, 0 to 3 percent slopes	1,315	.2	Total	584,960	100.0

soft masses of calcium carbonate make up less than 2 percent, by volume, of the horizon; calcareous; moderately alkaline; gradual, wavy boundary.

B24tca—35 to 66 inches, pink (5YR 8/4) sandy clay loam, pink (5YR 7/4) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; many, visible, soft masses and weakly cemented concretions of calcium carbonate make up about 45 percent, by volume, of the horizon; calcareous; moderately alkaline; gradual, wavy boundary.

B25t—66 to 80 inches, reddish-yellow (5YR 7/6) sandy clay loam, reddish yellow (5YR 6/6) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; few clay films; many, visible, soft masses of calcium carbonate make up about 25 percent, by volume, of the horizon; calcareous; moderately alkaline.

The A horizon ranges from brown to reddish brown in color and from 6 to 9 inches in thickness. The upper part of the Bt horizon ranges from reddish brown to yellowish red. It is sandy clay loam or clay loam that is 25 to 35 percent clay, and it is neutral to moderately alkaline. Structure is weak, medium to very coarse, prismatic parting to weak to moderate, fine to medium, subangular blocky. The Btca horizon is at a depth of 30 to 60 inches and is pink or reddish yellow. Soft masses and weakly cemented concretions of calcium carbonate make up about 20 to 60 percent, by volume, of this horizon. The part of the Bt horizon below the Btca horizon ranges from reddish yellow to yellowish red sandy clay loam or clay loam.

Acuff loam, 0 to 1 percent slopes (AcA).—This soil is on smooth uplands. Areas of this soil are irregular in shape and are 20 acres to several hundred acres in size. Slopes are convex and range mainly from 0.5 to 1 percent. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Amarillo, Patricia, Posey, Veal, Olton, and Estacado soils and Acuff loam, 1 to 3 percent slopes.

The hazards of soil blowing and water erosion are slight.

About 20 to 35 percent of this soil is cultivated. This soil is well suited to crops. Capability units IIIe–1, dryland, and I–2, irrigated; Deep Hardland range site.

Acuff loam, 1 to 3 percent slopes (AcB).—This soil is on uplands. Areas of this soil occur throughout the county. The areas are irregular in shape and range from 15 to 400 acres in size. Slopes are convex.

The surface layer is brown loam about 6 inches thick. The next layer is sandy clay loam that extends to a depth of more than 80 inches. The upper 30 inches of this layer is reddish brown in the upper part and yellowish red in the lower part. The lower 44 inches is pink in the upper part and reddish yellow in the lower part and is about 50 percent soft masses and weakly cemented concretions of calcium carbonate.

Included with this soil in mapping were small areas of Estacado, Patricia, and Olton soils and Acuff loam, 0 to 1 percent slopes.

The hazard of soil blowing is slight. The hazard of water erosion is moderate.

Most areas of this soil are used for range. About 15 percent of the acreage is cultivated. This soil is well suited to crops. Capability units IIIe–3, dryland, and IIe–2, irrigated; Deep Hardland range site.

Amarillo Series

The Amarillo series consists of deep, nearly level to gently sloping soils on uplands. These soils formed in friable loamy outwash and eolian materials.

In a representative profile the surface layer is brown fine sandy loam about 7 inches thick. The next layer is friable sandy clay loam that extends to a depth of 84 inches. The upper 10 inches is reddish brown, the next 10 inches is yellowish red, and the lower 57 inches is reddish yellow. This layer contains soft masses and weakly cemented concretions of calcium carbonate between depths of 43 and 84 inches. The visible content of these concretions ranges from 30 to 35 percent.

These soils are well drained. Internal drainage is medium. Permeability is moderate. The hazard of soil blowing is moderate, and the hazard of water erosion is slight to high.

Representative profile of Amarillo fine sandy loam, 1 to 3 percent slopes, in a cultivated field, 50 feet north of a county road, 0.15 mile east of the Dawson-Borden county line marker on Farm Road 1584, and 1 mile north and 0.57 mile east on rural road:

Ap—0 to 7 inches, brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) when moist; weak, fine, granular structure; hard, friable, mildly alkaline; abrupt, smooth boundary.

B21t—7 to 17 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) when moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; hard, friable, sticky; many fine pores; few clay films; mildly alkaline; clear, smooth boundary.

B22t—17 to 27 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; hard, friable, sticky; few fine pores; few clay films; calcareous below a depth of 24 inches; mildly alkaline to a depth of 24 inches, and moderately alkaline below a depth of 24 inches; clear, smooth boundary.

B23t—27 to 43 inches, reddish-yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; few films and threads of calcium carbonate; calcareous; moderately alkaline; clear, wavy boundary.

B24tca—43 to 58 inches, reddish-yellow (5YR 7/6) sandy clay loam, reddish yellow (5YR 6/6) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; many, visible, soft masses and weakly cemented concretions of calcium carbonate make up about 35 percent, by volume, of the horizon; calcareous; moderately alkaline; gradual, wavy boundary.

B25t—58 to 84 inches, reddish-yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; few clay films; many, visible, soft masses of calcium carbonate make up about 30 percent, by volume, of the horizon; calcareous; moderately alkaline.

The A horizon ranges from brown to reddish brown in color and from 7 to 9 inches in thickness. The upper part of the Bt horizon is reddish brown, reddish yellow, or yellowish red, and its reaction is mildly alkaline to moderately alkaline. Structure is weak, medium to very coarse, prismatic parting to weak, fine to medium, subangular blocky. The Btca horizon is at a depth of 34 to 60 inches. This horizon is pink or reddish yellow. Soft masses and concretions of calcium carbonate make up 20 to 40 percent of this

horizon. The B25t horizon ranges from reddish yellow to yellowish red. Soft lumps of calcium carbonate make up about 10 to 28 percent, by volume, of this horizon.

Amarillo fine sandy loam, 0 to 1 percent slopes (AmA).—This soil is on smooth uplands. The areas are irregular in shape and are 20 to 60 acres in size. Slopes are convex and range mainly from 0.3 to 1 percent.

The surface layer is brown fine sandy loam about 8 inches thick. The next layer is friable sandy clay loam that extends to a depth of 80 inches. The upper 40 inches of this layer is reddish brown in the upper part and yellowish red in the lower part, and the lower 32 inches is reddish yellow and contains soft masses and weakly cemented concretions of calcium carbonate. The visible content of the concretions is about 30 percent.

Included with this soil in mapping were small areas of Acuff and Estacado soils. Also included were areas of Amarillo fine sandy loam, 1 to 3 percent slopes.

The hazard of soil blowing is moderate, and the hazard of water erosion is slight. In some cultivated areas, part of the silt and clay in the plow layer has been removed by soil blowing, and the plow layer is more sandy than the original surface layer.

Most of this soil is cultivated. Some areas are used for range. Capability units IIIe–4, dryland, and IIe–4, irrigated; Sandy Loam range site.

Amarillo fine sandy loam, 1 to 3 percent slopes (AmB).—This soil has convex slopes that range mainly from 1 to 2.3 percent. The areas are irregular in shape and are 20 to 250 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Acuff, Estacado, and Patricia soils.

The hazards of soil blowing and water erosion are moderate. In the steeper areas a few gullies have formed. These gullies are 8 to 12 inches deep and 1 to 5 feet wide.

Areas of this soil are used for range and crops. Capability units IIIe–4, dryland, and IIe–3, irrigated; Sandy Loam range site.

Amarillo fine sandy loam, 3 to 5 percent slopes (AmC).—This soil is on convex ridges and side slopes along natural drainageways. The areas are oblong in shape and are 20 to 60 acres in size.

The surface layer is reddish-brown fine sandy loam about 7 inches thick. The upper 37 inches of the next layer is friable sandy clay loam that is reddish brown in the upper part and reddish yellow in the lower part. The lower 40 inches of this layer is reddish-yellow sandy clay loam that contains soft masses and weakly cemented concretions of calcium carbonate. The visible content of the concretions is about 20 percent.

Included with this soil in mapping were small areas of Spade, Veal, and Patricia soils. Also included were a few areas of soils that are underlain by sandstone at a depth of about 48 inches.

The hazard of soil blowing is moderate, and the hazard of water erosion is high. Sheet erosion has removed a part of the material from the plow layer in some cultivated areas. Where runoff water has concentrated, a few shallow gullies have formed. These gullies are 10 to 22 inches deep and 2 to 12 feet wide.

About 50 percent of the acreage is cultivated, and about 50 percent is used for range. Capability units IVe–4, dryland and IIIe–1, irrigated; Sandy Loam range site.

Arch Series

The Arch series consists of nearly level to gently sloping soils on uplands. These soils are shallow. They formed in friable chalky outwash alluvium.

In a representative profile the surface layer is grayish-brown loam about 8 inches thick. The next layer is light brownish-gray clay about 12 inches thick. The underlying material is white clay loam that extends to a depth of 60 inches and contains visible soft masses of calcium carbonate. The visible content of these masses is about 60 percent.

These soils are well drained. Internal drainage is rapid. Permeability is moderate. Because the content of lime is high, some nutrients are not available to plants. The hazards of water erosion and soil blowing are slight.

Representative profile of Arch loam, 0 to 3 percent slopes, 0.6 mile west and 0.12 mile south of northeast corner of sec. 15, block 10, E.L.&R.R. survey; 4.4 miles east and 0.1 mile south of the Borden-Lynn county line marker on Farm Road 1054:

A1—0 to 8 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular and fine, subangular blocky structure; hard, friable, sticky; common fine roots and pores; calcareous; moderately alkaline; clear, smooth boundary.

B2—8 to 20 inches, light-brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) when moist; weak, coarse, prismatic structure parting to weak, fine, subangular blocky; hard, friable, slightly sticky; common fine roots and pores; few films and threads of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

C1ca—20 to 40 inches, white (10YR 8/2) clay loam, light gray (10YR 7/2) when moist; weak, fine, subangular blocky structure; slightly hard, friable, sticky; many, fine, weakly cemented concretions and soft masses of calcium carbonate make up about 60 percent, by volume, of the horizon; calcareous; moderately alkaline; diffuse, wavy boundary.

C2—40 to 60 inches, light-gray (10YR 7/2) clay loam, light brownish gray (10YR 6/2) when moist; massive; slightly hard, friable, sticky; many soft masses and weakly cemented concretions of calcium carbonate make up about 35 percent, by volume, of the horizon; calcareous; moderately alkaline.

The A horizon is grayish brown or light brownish gray and ranges from 6 to 10 inches in thickness. Structure ranges from weak granular to weak subangular blocky. The B2 horizon is light brownish gray or pale brown and ranges from 9 to 12 inches in thickness. Depth to the C1ca horizon ranges from 15 to 20 inches. This horizon is white or light gray. Calcium carbonate makes up 40 to 68 percent, by volume, of this horizon. The C2 horizon is white or light gray.

Arch loam, 0 to 3 percent slopes (ArB).—This soil is in areas that are irregular in shape and range from 95 to 406 acres in size. Slopes range mainly from 0.1 to 3 percent but average about 0.1 percent.

Included with this soil in mapping were small areas of lower lying Estacado soils.

The hazards of soil blowing and water erosion are slight.

Areas of this soil are used for range. Capability unit IVe–3, dryland; High Lime range site.

Badland

Badland (Ba) consists mainly of shales and clays of Triassic red beds. It is the result of geologic erosion that has cut into the red-bed formation. This land type is on the escarpments that border the level soils on the uplands and in areas below the escarpments that are dissected by large gullies and by bald ridges and knobs of red-bed material (fig. 8). The slope is mainly 2 to 10 percent, but it ranges from 20 to 80 percent along some of the gullies and escarpments. Areas of this land type are irregular in shape and range from 10 to 200 acres in size.

Included with this land type in mapping were small areas of Vernon soils and small outcrops and ledges of sandstone.

There is very little vegetation on this land type. About 95 percent is bare ground. Capability unit VIII–1, dryland; not placed in a range site.

Berda Series

The Berda series consists of deep, gently sloping loamy soils on uplands. These soils formed in local colluvial material.

In a representative profile the surface layer is grayish-brown loam about 11 inches thick. The next layer extends to a depth of 48 inches. It is pale-brown loam in the upper 15 inches and light yellowish-brown clay loam in the lower 22 inches. The underlying material is pink clay loam that reaches a depth of 84 inches.

These soils are well drained. Runoff and internal drainage are medium. Permeability is moderate. The hazard of soil blowing is slight. The hazard of water erosion is moderate to high.

Representative profile of Berda loam, 1 to 3 percent slopes, in a pasture 70 feet west of Farm Road 1054, 2.05 miles north of intersection of Farm Road 1054 and U.S. Highway 180:

A1—0 to 11 inches, grayish-brown (10YR 5/2) loam dark grayish brown (10YR 4/2) when moist; weak, coarse, prismatic structure parting to weak, fine, subangular blocky; hard, friable, sticky; many fine roots and pores; few wormcasts; few, very fine, weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B2—11 to 26 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) when moist; weak, coarse, prismatic structure parting to weak, fine, subangular blocky; hard, friable, sticky; few fine roots, many fine pores, common wormcasts; few films, threads, and weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B2ca—26 to 48 inches, light yellowish-brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; few visible film, threads, and fine weakly cemented concretions of calcium carbonate make up about 5 percent, by volume, of the horizon; calcareous; moderately alkaline, gradual, wavy boundary.

Cca—48 to 84 inches, pink (7.5YR 7/4) clay loam, light brown (7.5YR 6/4) when moist; massive; hard, friable, sticky; few visible films, threads, and weakly cemented concretions of calcium carbonate make up about 2 percent, by volume, of the horizon; calcareous; moderately alkaline.

Figure 8.—Scant vegetation in area of Badland

The A horizon is brown or grayish brown and ranges from 6 to 14 inches in thickness. The B2 horizon is reddish-brown, pale-brown, or light brownish-gray loam or clay loam and ranges from 8 to 25 inches in thickness. The B2ca horizon ranges from light yellowish-brown and pink to reddish-brown loam or clay loam. Content of visible calcium carbonate ranges from 3 to 13 percent, by volume, of this horizon. Depth to the Cca horizon ranges from 40 to 60 inches. This horizon is light-brown to pink loam or clay loam. Content of visible calcium carbonate ranges from 1 to 8 percent, by volume, of this horizon.

Berda loam, 1 to 3 percent slopes (BeB).—This soil has convex slopes that range mainly from 2 to 3 percent. It is below areas of Potter soils and Rough broken land. The areas are irregular in shape and range from 30 acres to several hundred acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Mobeetie, Posey, and Weymouth soils. Also included were a few, small, eroded areas of Berda soils. These eroded areas have gullies that are 2 to 4 feet deep and 2 to 8 feet wide. There are also a few areas of Berda loam, 3 to 5 percent slopes.

The hazard of water erosion is moderate. The hazard of soil blowing is slight.

Most areas of this soil is used for range. Capability unit IIIe–7, dryland; Deep Hardland range site.

Berda loam, 3 to 5 percent slopes (BeC).—This soil has convex slopes. It is below areas of Potter soils and Rough broken land. These areas are irregular in shape and range from 15 to 100 acres in size.

The surface layer is brown loam about 9 inches thick. The next layer extends to a depth of 46 inches. It is pale-brown loam in the upper 13 inches and light yellowish-brown clay loam in the lower 24 inches. It contains weakly cemented concretions of calcium carbonate. The content of concretions is about 3 percent.

Included with this soil in mapping were small areas of Posey and Mobeetie soils. Also included were a few areas of Berda loam, 1 to 3 percent slopes, and areas of this Berda soil that are eroded. These eroded areas have gullies 3 to 6 feet deep and 2 to 10 feet wide.

The hazard of water erosion is high. The hazard of soil blowing is slight.

Areas of this soil are used entirely for range. Capability unit IVe–2, dryland; Deep Hardland range site.

Bippus Series

The Bippus series consists of deep, nearly level to gently sloping soils on uplands. These soils formed in local alluvial and colluvial materials.

In a representative profile the surface layer is dark-brown clay loam about 18 inches thick. The next layer is dark-brown to brown, calcareous clay loam that extends to a depth of 74 inches.

These soils are well drained. Runoff and internal drainage are medium. Permeability is moderate. The hazard of water erosion is slight to moderate.

Representative profile of Bippus clay loam, 1 to 3 percent slopes, in a pasture 0.45 mile east and 0.53 mile south of the northwest corner of sec. 28, block 31, T.&P.R.R. Co. survey; or from a point 2 miles east of the Mesquite Church, 0.53 mile south, 3.45 miles east of a county road:

A11—0 to 8 inches, dark-brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) when moist; weak, fine, granular structure and fine, subangular blocky; hard, friable, sticky; many roots and fine pores; calcareous; moderately alkaline; gradual, smooth boundary.

A12—8 to 18 inches, dark-brown (7.5YR 4/3) clay loam, dark brown (7.5YR 3/3) when moist; weak, coarse prismatic structure parting to weak, fine to medium, subangular blocky; hard, friable, sticky; common roots; many fine pores; many worm casts; calcareous; moderately alkaline; gradual, smooth boundary.

B21ca—18 to 36 inches, dark-brown (7.5YR 4/3) clay loam, dark brown (7.5YR 3/3) when moist; weak, coarse, prismatic structure parting to weak, fine to medium, subangular blocky; hard, friable, sticky; few, very fine, weakly cemented concretions of calcium carbonate make up about 2 percent, by volume, of the horizon; calcareous; moderately alkaline; gradual, smooth boundary.

B22ca—36 to 74 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; few, very fine, weakly cemented concretions, films, and threads of calcium carbonate; calcareous; moderately alkaline.

The A horizon ranges from 15 to 30 inches in thickness. It is dark brown or dark grayish brown. Structure ranges from weak granular to weak, fine to medium, subangular blocky. The B21ca horizon is brown, dark brown, or dark grayish brown and ranges from 12 to 27 inches in thickness. Content of visible calcium carbonate ranges from 1 to 5 percent, by volume. Structure is weak, coarse, prismatic parting to weak, fine to medium, subangular blocky. The B22ca horizon is brown or reddish brown. Content of visible calcium carbonate ranges from 1 to 5 percent, by volume.

Bippus clay loam, 0 to 1 percent slopes (BpA).—This soil is along old alluvial drainageways. The areas are irregular in shape or oblong and range from 15 to 180 acres in size. Slopes average about 0.8 percent.

The surface layer is clay loam about 20 inches thick. It is dark brown in the upper part and dark grayish brown in the lower part. The next layer extends to a depth of 60 inches. It is dark-brown clay loam in the upper 16 inches and reddish-brown clay loam in the lower 24 inches.

Included with this soil in mapping were small areas of Spur, Berda, and Rotan soils. Also included were areas of Bippus clay loam, 1 to 3 percent slopes.

The hazard of water erosion is slight.

Areas of this soil are used for range. Capability unit IIe–2, dryland; Deep Hardland range site.

Bippus clay loam, 1 to 3 percent slopes (BpB).—This soil is along old alluvial drainageways. The areas are irregular in shape or oblong and range from 50 to 200 acres in size. Slopes are convex and average about 1.6 percent. This soil has the profile described as representative for the series.

Included with this soil in mapping were areas of Berda, Spur, and Rotan soils. Also included were areas of Bippus clay loam, 0 to 1 percent slopes.

The hazard of water erosion is moderate.

Areas of this soil are used for range. Capability unit IIIe–2, dryland; Deep Hardland range site.

Brownfield Series

The Brownfield series consists of deep, nearly level to gently undulating soils on uplands. These soils formed in friable, eolian, loamy and sandy sediment.

In a representative profile the surface layer is fine sand about 26 inches thick. The upper 7 inches is brown, and the lower 19 inches is light brown. The next layer is sandy clay loam 36 inches thick. It is yellowish red in the upper part and reddish yellow in the lower part. The underlying material is reddish-yellow loamy fine sand.

These soils are well drained. Runoff is very slow. Internal drainage is medium. Permeability is moderate. The hazard of soil blowing is high.

Representative profile of Brownfield fine sand, in a pasture 1.1 miles south of Farm Road 1610 from a point 1.0 mile west of the Borden-Scurry county line marker on Farm Road 1610:

A1—0 to 7 inches, brown (7.5YR 5/4) fine sand, dark brown (7.5YR 4/4) when moist; single grained; loose, nonsticky; common roots; neutral; gradual, smooth boundary.

A2—7 to 26 inches, light-brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) when moist; single grained; loose, nonsticky; few roots; slightly acid; clear, smooth boundary.

B21t—26 to 38 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; moderate, coarse, prismatic structure parting to weak, medium, subangular blocky; hard, friable, sticky; few fine pores; common clay films on vertical faces of prisms; slightly acid; gradual, smooth boundary.

B22t—38 to 62 inches, reddish-yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) when moist; weak, fine, subangular blocky structure; hard, friable, slightly sticky; few clay films; neutral; gradual, smooth boundary.

C—62 to 84 inches, reddish-yellow (7.5YR 7/6) loamy fine sand, reddish yellow (7.5YR 6/6) when moist; single grained; hard, friable, nonsticky; neutral.

The A horizon is brown or light brown and ranges from 20 to 36 inches in thickness. Reaction is slightly acid to neutral. The Bt horizon is fine sandy loam or sandy clay loam that ranges from red to reddish yellow or yellowish red. Depth to the C horizon is more than 60 inches. This horizon is fine sandy loam or loamy fine sand that is reddish yellow or yellowish red.

Brownfield fine sand (Br).—This nearly level to gently undulating soil is on uplands. Slopes are as much as 3 percent. These areas are irregular in shape and as large as 1,900 acres. In about 25 percent of the total acreage, this soil has a buried sandy soil at a depth of 32 to 60 inches.

Included with this soil in mapping were small mounds of a fine sand more than 80 inches thick over a more clayey layer; small areas of Patricia soils; and a few areas of Brownfield soils that are severely eroded.

The hazard of soil blowing is high.

Areas of this soil are used mainly for range. A few soil areas have been cultivated but are now abandoned. In formerly cultivated areas, fence-row dunes as high as 5 feet are common. Capability unit VIe–3, dryland; Deep Sand range site.

Colorado Series

The Colorado series consists of deep, nearly level soils that are on flood plains throughout the county. These soils formed in loamy alluvium.

In a representative profile the surface layer is calcareous reddish-brown clay loam about 6 inches thick. The underlying material is calcareous reddish-brown clay loam that extends to a depth of 50 inches.

These soils are well drained. Internal drainage is medium. Permeability is moderate.

Representative profile of Colorado clay loam in an area of Colorado and Spur soils, in a pasture 3.3 miles east of a county road from a point about 12.5 miles west of Gail on U.S. Highway 180, 11 miles south on county road:

A1—0 to 6 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; many fine roots, many fine pores; calcareous; moderately alkaline; clear, smooth boundary.

C1—6 to 20 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) when moist; thin, platy structure related to bedding planes; stratified with thin lenses of very fine sandy loam; hard, friable, sticky; few roots; common fine pores; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

C2—20 to 50 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) when moist; massive; hard, friable, sticky; few fine pores; few films and threads of calcium carbonate; thin strata of silt loam and very fine sandy loam; calcareous; moderately alkaline.

The A horizon is brown or reddish-brown loam or clay loam and ranges from 5 to 14 inches in thickness. The C horizon is yellowish-red or reddish-brown very fine sandy loam or clay loam. Bedding planes are evident throughout the profile, but parts of the C1 horizon show evidence of weak structural development.

Colorado and Spur soils (Co).—This undifferentiated group consists of soils on the flood plains of most major streams, small creeks, and intermittent drainageways. Colorado soils make up about 50 percent of this mapping unit, Spur soils about 40 percent, and other soils the remaining 10 percent. Some tracts consist of intermingled areas of Colorado and Spur soils, and some consist of just one of the soils. Slopes are 0 to 1 percent. The flood plains are subject to frequent flooding during normal and high rainfall. They are dissected by old creek beds and by channels that wander back and forth across the flood plains. The flood plains are 100 to 400 yards wide and are continuous. Areas of this mapping unit range from 80 to 450 acres in size.

A Colorado soil in this undifferentiated group has the profile described as representative for the Colorado series. The Colorado soils have a surface layer of clay loam in some areas and loam in others.

The Spur soils have a surface layer of brown calcareous clay loam about 15 inches thick. The next layer is brown calcareous clay loam 19 inches thick. The underlying material is calcareous reddish-brown clay loam that extends to a depth of more than 50 inches.

Included with these soils in mapping were areas of Mangum and Bippus soils. Also included were a few areas, along the Colorado River, of soils that are simi-

lar to Colorado soils but have a surface layer of pale-brown to yellowish-red very fine sandy loam or fine sandy loam and lower layers of very fine sandy loam to fine sand.

Unless these soils are protected from flooding, they are not suited to cultivation.

These soils are used for range. Capability unit Vw–1, dryland; Bottomland range site.

Estacado Series

The Estacado series consists of deep, nearly level to gently sloping soils on uplands. These soils formed in friable loamy outwash and eolian material.

In a representative profile the surface layer is dark-brown calcareous clay loam about 14 inches thick. In sequence from the top, the next layer is reddish-brown calcareous clay loam in the upper 14 inches; pink calcareous clay loam in the next 28 inches; and reddish-yellow clay loam in the lower 24 inches. This layer is as much as 35 percent visible soft masses of calcium carbonate.

These soils are well drained. Runoff is slow. Internal drainage is medium. Permeability is moderate. The hazard of soil blowing is slight. The hazard of water erosion is slight to moderate.

Representative profile of Estacado clay loam, 0 to 1 percent slopes, in a cultivated field one-half mile north of Farm Road 1054 from a point 1.5 miles north and 0.5 mile west of intersection of Farm Road 1054 and Farm Road 1210:

Ap—0 to 7 inches, dark-brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) when moist; weak, fine, granular structure; hard, friable, sticky; common fine pores; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—7 to 14 inches, dark-brown (7.5YR 4/3) clay loam, dark brown (7.5YR 3/3) when moist; weak, coarse, prismatic structure parting to weak, fine, subangular blocky; hard, friable, sticky; many fine pores; few films and threads of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

B21tca—14 to 28 inches, reddish-brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) when moist; weak, coarse, prismatic structure parting to moderate, fine to medium, subangular blocky; hard, friable, sticky; common pores and worm casts; few clay films; few films and threads of calcium carbonate; calcareous; moderately alkaline; clear boundary.

B22tca—28 to 56 inches, pink (5YR 7/4) clay loam, light reddish brown (5YR 6/4) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; many soft masses of calcium carbonate make up about 35 percent, by volume, of the horizon; calcareous; moderately alkaline; gradual, wavy boundary.

B23tca—56 to 80 inches, reddish-yellow (5YR 7/6) clay loam, reddish yellow (5YR 6/6) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; few clay films; common soft masses of calcium carbonate make up about 10 percent, by volume, of the horizon; calcareous; moderately alkaline.

The A horizon is reddish brown, dark brown, or dark grayish brown and ranges from 10 to 20 inches in thickness. Structure is weak, fine, granular; weak, fine, subangular blocky or weak, coarse, prismatic. The B21tca horizon is brown or reddish brown and ranges from 7 to 19 inches in thickness. Structure ranges from weak, coarse, prismatic to weak, fine to medium, subangular blocky. The B22tca horizon is pink or reddish yellow. Calcium carbonate content ranges from 20 to 50 percent, by volume. Depth to the B23tca horizon ranges from 36 to 60 inches. This horizon is reddish yellow or yellowish red.

Estacado clay loam, 0 to 1 percent slopes (EsA).—This soil is on uplands. Slopes range mainly from 0.3 to 1 percent and average about 0.7 percent. The areas are irregular in shape and range from 20 acres to several hundred acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Olton, Lofton, Acuff, and Posey soils and Estacado clay loam, 1 to 3 percent slopes.

The hazards of soil blowing and water erosion are slight.

The areas of this soil are used for range and crops. The areas used for range are in short grasses. A few areas are irrigated. Capability units IIIe–1, dryland, and I–2, irrigated; Deep Hardland range site.

Estacado clay loam, 1 to 3 percent slopes (EsB).—This soil is in convex areas around playas and along old natural drainageways. Most areas are less than 100 acres in size. Slopes average about 2 percent.

The surface layer is dark-brown calcareous clay loam about 13 inches thick. The next layer reaches to a depth of 80 inches. It is brown calcareous clay loam in the upper 13 inches, and the lower 54 inches is calcareous clay loam that is pink in the upper part and reddish yellow in the lower part and contains about 40 percent visible calcium carbonate.

Included with this soil in mapping were small areas of Posey, Acuff, and Olton soils and Estacado clay loam, 0 to 1 percent slopes.

The hazard of water erosion is moderate. The hazard of soil blowing is slight.

Most areas of this soil are cultivated. Capability units IIIe–3, dryland, and IIe–2, irrigated; Deep Hardland range site.

Kimbrough Series

The Kimbrough series consists of very shallow to shallow, gently sloping to sloping soils on uplands. These soils formed in friable loamy material underlain by indurated caliche.

In a representative profile the surface layer is dark grayish-brown loam, about 8 inches thick, that rests abruptly on a layer of indurated caliche plates about 16 inches thick. Below this is a layer of weakly cemented caliche plates that extends to a depth of 50 inches.

These soils are well drained. Internal drainage is medium. Permeability is moderate. The hazard of soil blowing is slight. The hazard of water erosion is moderate.

Representative profile of Kimbrough loam in an area of Kimbrough soils, 0.3 mile south of the northwest corner of sec. 29, block 21, T.&P.R.R. survey; 1.57 miles south, 0.93 mile east of Joe Clayton Ranch headquarters:

A1—0 to 8 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist;

weak, fine, platy structure in upper 2 inches, grading to weak, fine, subangular blocky in lower part; slightly hard, friable, slightly sticky; common roots and pores; common hard caliche fragments; calcareous; moderately alkaline; abrupt, smooth boundary.

C1cam—8 to 24 inches, white indurated caliche; platy, calcareous; smooth, wavy boundary.

C2—24 to 50 inches, pinkish-white (5YR 8/2) weakly cemented caliche; platy; calcareous.

The A horizon is brown or dark grayish-brown loam or clay loam. Structure ranges from weak platy in upper 1 to 2 inches to weak, fine, subangular blocky in the lower part. The C1cam horizon is at a depth of 7 to 20 inches. The indurated caliche layer is generally 1 to 3 feet thick and is underlain by softer, more massive caliche that is many feet thick.

Kimbrough soils (Km).—These gently sloping to sloping soils are on uplands. The areas are above and adjacent to areas of Rough broken land. These areas are irregular in shape and range from 12 acres to several hundred acres in size. Slopes are convex and range from 1 to 8 percent. As much as 15 percent of the surface layer is covered by hard caliche fragments.

Included with these soils in mapping were areas of Slaughter, Stegall, and Olton soils and Rough broken land.

The hazard of water erosion is moderate. The hazard of soil blowing is slight.

Areas of these soils are used for range. These soils are not suited to cultivation. Capability unit VIIs–1, dryland; Very Shallow range site.

Latom Series

The Latom series consists of very shallow to shallow, gently sloping to moderately steep soils on uplands. These soils formed in friable loamy sediment over sandstone.

In a representative profile the surface layer is brown fine sandy loam about 9 inches thick. This layer rests abruptly on sandstone.

These soils are well drained. Runoff is slow. Internal drainage is medium. Permeability is moderate.

Latom soils are used for range.

Representative profile of Latom fine sandy loam in an area of Latom soils, in a pasture 50 feet south of Farm Road 1785 from a point 0.1 mile west of intersection of Farm Road 1785 and Farm Road 669:

A1—0 to 9 inches, brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) when moist; massive; soft, friable, nonsticky; few fine roots; few sandstone fragments; calcareous; moderately alkaline; abrupt, smooth boundary.

R—9 to 20 inches, strongly cemented calcareous sandstone; thin discontinuous coatings of calcium carbonate in crevices.

The A horizon is reddish-brown, brown, or yellowish-brown fine sandy loam to stony fine sandy loam. It ranges from 4 to 20 inches in thickness.

Latom soils (La).—These gently sloping to moderately steep soils are on ridges and knolls on uplands and along natural drainageways. The areas are elongated or irregular in shape and range from 15 to 100 acres in size. Slopes are convex and range from 2 to 20 percent but average about 8 percent.

Included with these soils in mapping were areas of Spade, Patricia, Vernon, Colorado, and Spur soils. Also included were areas of soils where large sandstone boulders protrude above the surface.

Areas of these soils are used for range. Capability unit VIIs–1, dryland; Very Shallow range site.

Lipan Series

The Lipan series consists of deep, nearly level soils on the floor of enclosed depressions and intermittent lakes or playas. These soils formed in calcareous clayey sediment.

In a representative profile the surface layer is very firm gray clay about 20 inches thick. The next layer is gray clay about 24 inches thick. The underlying material is gray clay that contains a few concretions of calcium carbonate and reaches to a depth of 75 inches.

These soils are moderately well drained. Runoff is ponded. Internal drainage and permeability are very slow. The hazards of soil blowing and water erosion are very slight.

Lipan soils are used for range and crops.

Representative profile of Lipan clay in a pasture 50 feet north of a county road from a point 0.4 mile north on Farm Road 1054, 0.75 mile west of intersection of Farm Road 1054 and Farm Road 1210:

A1—0 to 20 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) when moist; weak, blocky structure; extremely hard, very firm, very sticky and plastic; common fine roots, mildly alkaline; gradual, smooth boundary.

AC—20 to 44 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) when moist; weak, blocky structure and massive; extremely hard, very firm, very sticky and plastic; peds have shiny pressure faces; few slickensides; mildly alkaline; gradual, wavy boundary.

Cca—44 to 75 inches, gray (10YR 6/1) clay, gray (10YR 5/1) when moist; massive; extremely hard, very firm, very sticky and plastic; few concretions of calcium carbonate; calcareous; moderately alkaline.

The A horizon ranges from gray to dark gray in color and from 13 to 24 inches in thickness. Reaction is mildly alkaline to moderately alkaline. The AC horizon ranges from gray to dark gray and from 19 to 40 inches in thickness. The Cca horizon is at a depth of 40 to 50 inches. It is gray or light gray. Calcium carbonate content ranges from 1 to 10 percent, by volume.

Lipan clay (Ln).—This nearly level soil is on the floor of deep depressional areas, or playas. The drop from the surrounding plain to the playa bottoms ranges from 3 to 20 feet. Slopes are 0 to 1 percent. The areas are circular or oval and range from 15 to 100 acres in size.

Included with this soil in mapping were small areas of Lofton soils.

Runoff from surrounding areas covers this soil to a depth of a few inches to several feet. After rains, these areas are ponded for a few days to several weeks. When this soil is dry, cracks 1 to 2 inches wide and as deep as 24 inches are common.

About 60 percent of this soil is cultivated. However, half of the time crops are not grown because of excess water or because the soil is too dry. There is no runoff. The areas of this soil that are still in range

have a gilgai microrelief made up of enclosed microbasins and microknolls. The areas of gilgai relief are 6 to 16 inches deep, 2 to 5 feet wide, and 5 to 20 feet apart. After a few years of cultivation, the microbasins are filled in and become less evident. Capability unit IVw–1, dryland; not placed in a range site.

Lofton Series

The Lofton series consists of deep, nearly level soils that are in slightly depressional concave areas. These soils formed in calcareous, clayey, old alluvium.

In a representative profile the surface layer is a dark grayish-brown clay loam about 7 inches thick. The next layer, in sequence from the top, is 15 inches of dark grayish-brown clay; 22 inches of grayish-brown clay; and 48 inches of light-gray clay and clay loam that contains soft masses of calcium carbonate. The visible content of these masses is 16 to 23 percent.

These soils are moderately well drained. Runoff is very slow. Internal drainage is slow. Permeability is very slow.

Representative profile of Lofton clay loam, in a cultivated field, 0.27 mile east of a county road from a point 1.0 mile east and 0.73 mile north of Mesquite Church:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) clay loam; very dark grayish brown (10YR 3/2) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; common fine pores; mildly alkaline; abrupt, smooth boundary.

B21t—7 to 22 inches, dark grayish-brown (10YR 4/2) clay; very dark grayish brown (10YR 3/2) when moist; moderate, medium, blocky structure; very hard, firm, sticky and plastic; few very fine pores; thin clay films; mildly alkaline; clear, smooth boundary.

B22t—22 to 35 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) when moist; moderate, medium, blocky structure, very hard, firm, sticky and plastic; few very fine pores; thin clay films; some peds show pressure faces; few, very fine, weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B23t—35 to 44 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) when moist; weak, medium, blocky structure; very hard, firm, sticky and plastic; few clay films; few weakly cemented concretions and soft masses of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B24tca—44 to 60 inches, light-gray (2.5Y 7/2) clay, light brownish gray (2.5Y 6/2) when moist, weak, fine, subangular blocky structure; very hard, firm, sticky and plastic; many, visible, soft masses of calcium carbonate make up about 23 percent, by volume, of the horizon; calcareous; moderately alkaline; gradual, wavy boundary.

B25t—60 to 92 inches, light-gray (5Y 7/2) clay loam; light olive gray (5Y 6/2) when moist; weak, fine, subangular blocky; hard, friable, sticky; many, visible, soft masses of calcium carbonate make up about 16 percent, by volume, of the horizon; calcareous; moderately alkaline.

The A horizon is dark grayish brown or grayish brown and ranges from 6 to 10 inches in thickness. The B21t horizon is dark gray or dark grayish brown and ranges from 8 to 16 inches in thickness. The B22t horizon is grayish brown or dark grayish brown and ranges from 10 to 18 inches in thickness. The B23t horizon is gray to grayish brown and ranges from 9 to 26 inches in thickness. The B24tca horizon is at a depth of 40 to 60 inches. This horizon is light gray or grayish brown. The B25t horizon is at a depth of 56 to 70 inches. This horizon is light gray or grayish brown.

Lofton clay loam (Lo).—This soil is in concave, slightly depressional areas. The areas are circular to oval and range from 15 to 90 acres in size. Slopes range from 0.2 to 0.6 percent.

Included with this soil in mapping were small areas of Olton and Estacado soils. Also included were narrow bands of Rowena and Rotan soils and small, circular, lower lying areas of Lipan soils.

After heavy rainfall this soil is ponded for periods as long as 3 weeks. This ponding may delay the harvesting of crops. When this soil is dry, cracks 0.3 to 1.5 inches wide and 20 to 24 inches deep are common.

If surface drainage is provided, this soil is suited to crops. About 90 percent of the acreage of this soil is cultivated. Capability units IIIe–5, dryland, and IIs–1, irrigated; Deep Hardland range site.

Mangum Series

The Mangum series consists of deep, nearly level soils along the flood plains of the Colorado River, McCullum Creek, Gavett Creek, Bull Creek, and their tributaries. These soils formed in clayey alluvial sediment.

In a representative profile the surface layer is reddish-brown clay about 11 inches thick. The underlying material is clay that is reddish brown in the upper part and yellowish red in the lower part and extends to a depth of 48 inches.

These soils are well drained. Runoff and internal drainage are slow. Permeability is very slow. The hazards of soil blowing and water erosion are slight.

These soils are used for range.

Representative profile of Mangum clay, channeled, in a pasture 200 feet south and 100 feet west of Bull Creek Bridge on Farm Road 1610:

A1—0 to 11 inches, reddish-brown (5YR 5/3) clay, reddish brown (5YR 4/3) when moist; moderate, fine to medium, blocky structure; very hard, firm, very sticky and plastic; many fine roots; mildly alkaline; clear, smooth boundary.

C1—11 to 37 inches, reddish-brown (5YR 5/4) clay reddish brown (5YR 4/4) when moist; massive; very hard, very firm, very sticky and plastic; few fine roots; few very fine pores; stratified with thin lenses of silty clay loam and clay loam; calcareous; moderately alkaline; gradual, smooth boundary.

C2—37 to 48 inches, yellowish-red (5YR 5/6) clay, yellowish red (5YR 4/6) when moist; massive, very hard, firm, very sticky and plastic; stratified with thin lenses of clay loam and silt loam; calcareous; moderately alkaline.

The A horizon ranges from 5 to 15 inches in thickness. It is clay loam or clay. Structure is weak to moderate, fine to medium, subangular blocky and blocky. The C horizon is red to reddish-brown silty clay or clay.

Mangum clay (Ma).—This nearly level soil is on weakly concave bottom lands along the flood plains of major creeks and rivers. The areas range from 0.2 to 0.7 mile in width, are as much as a mile in length, and range from 20 to 600 acres in size. Slopes are 0 to 1 percent.

The surface layer is reddish-brown clay about 10 inches thick. The underlying material is massive reddish-brown clay that extends to a depth of more than 50 inches.

Included with this soil in mapping were small areas of Mangum clay, channeled. Also included were areas of Stamford and Colorado soils.

When this soil is dry, cracks 0.5 to 1 inch wide and 20 to 24 inches deep are common.

Areas of this soil are used for range. Capability unit IIIs–1, dryland; Clay Flats range site.

Mangum clay, channeled (Mc).—This soil is on weakly concave bottom lands that are subject to frequent flooding. The areas are long and narrow. They range from 0.1 to 0.6 mile in width, from 1 mile to several miles in length, and from 30 acres to several hundred acres in size. Most areas of this soil are so dissected by wandering channels of intermittent streams that the smooth fields are small. In addition, these areas are flooded more frequently than the other Mangum soils. The channels are 4 to 70 feet wide and 4 to 20 feet deep. Slopes are mainly less than 1 percent, but slopes are as much as 4 percent on some narrow benches, on streambanks, and in gullied areas. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Colorado and Spur soils.

When this soil is dry, cracks form that range from 0.5 to 1 inch in width and 20 to 24 inches in depth.

Areas of this soil are used for range. Capability unit VIs–2, dryland; Clay Flats range site.

Mobeetie Series

The Mobeetie series consists of deep, gently sloping soils on uplands. These soils formed in loamy sediment of local colluvial material.

In a representative profile the surface layer is very friable, brown, calcareous fine sandy loam about 10 inches thick. The next layer is calcareous fine sandy loam 36 inches thick. The upper part is brown and the lower part is light brown. The underlying material is pink fine sandy loam that reaches a depth of more than 60 inches. Weakly cemented concretions of calcium carbonate are present below a depth of 26 inches. The visible content of these concretions is about 2 percent.

These soils are well drained. Runoff and internal drainage are medium. Permeability is moderately rapid. The hazards of soil blowing and water erosion are moderate.

Most areas of these soils are used for range.

Representative profile of Mobeetie fine sandy loam, 1 to 3 percent slopes, in a pasture 0.7 mile south of a county road, from a point about 12.5 miles west of Gail on Texas Highway 180, 7.0 miles south on county road, 5.4 miles southwest on county road:

A1—0 to 10 inches, brown (7.5YR 5/3) fine sandy loam, dark brown (7.5YR 4/3) when moist; weak, fine, granular structure; slightly hard, very friable; many fine roots and pores; calcareous; moderately alkaline; clear, smooth boundary.

B2—10 to 26 inches, brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) when moist; weak, medium, prismatic structure parting to weak, fine, subangular blocky; slightly hard, very friable; many fine roots and pores; few visible films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B3ca—26 to 46 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) when moist; weak, fine, subangular blocky structure; slightly hard, very friable; few, visible, fine weakly cemented concretions and films and threads of calcium carbonate make up about 2 percent, by volume, of the horizon; calcareous; moderately alkaline; gradual, wavy boundary.

C—46 to 60 inches, pink (7.5YR 7/4) fine sandy loam, light brown (7.5YR 6/4) when moist; massive; hard, very friable; few, visible, fine, weakly cemented concretions and films and threads of calcium carbonate make up less than 2 percent, by volume, of the horizon; calcareous; moderately alkaline.

The A horizon is grayish brown or brown and ranges from 8 to 12 inches in thickness. Structure ranges from weak granular to weak subangular blocky. The B2 horizon is brown or light brown and ranges from 15 to 20 inches in thickness. Structure is weak, medium to coarse, prismatic parting to weak subangular blocky. The B3ca horizon is at a depth of 18 to 24 inches. This horizon is pink, light-brown, or reddish-yellow loam or fine sandy loam that is less than 18 percent clay. Visible soft masses and weakly cemented concretions of calcium carbonate make up about 1 to 6 percent, by volume, of this horizon. Depth of the C horizon ranges from 24 to 60 inches. This horizon is pink or reddish yellow.

Mobeetie fine sandy loam, 1 to 3 percent slopes (MoB).—This soil is below areas of Potter soils and Rough broken land. The areas are irregular in shape and range from 20 to 200 acres in size. Slopes are convex and range mainly from 2 to 3 percent.

Included with this soil in mapping were small areas of Berda loam and Veal fine sandy loam. Also included were a few areas of Spade fine sandy loam.

The hazards of soil blowing and water erosion are moderate.

Most areas of this soil are used for range. Capability unit IIIe–8, dryland; Sandy Loam range site.

Olton Series

The Olton series consists of deep, nearly level to gently sloping soils on uplands. These soils formed in loamy outwash and eolian material.

In a representataive profile the surface layer is brown clay loam about 7 inches thick. In sequence from the top, the next layer is 9 inches of calcareous reddish-brown clay loam; 13 inches of calcareous reddish-brown clay; 15 inches of yellowish-red clay loam; and 36 inches of reddish-yellow clay loam that has soft masses and weakly cemented concretions of calcium carbonate. The visible content of these concretions is 20 to 30 percent.

These soils are well drained. Runoff and internal drainage are slow. Permeability is moderately slow.

These soils are used for range and crops.

Representative profile of Olton clay loam, 0 to 1 percent slopes, in a pasture, 50 feet west of Farm Road 1610 from a point 2.96 miles south of intersection of Farm Road 1610 and U.S. Highway 180:

A1—0 to 7 inches, brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) when moist; weak, fine, suban-

gular blocky structure; hard, friable, sticky; many fine roots; few fine pores; mildly alkaline; clear, smooth boundary.

B21t—7 to 16 inches, reddish-brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) when moist; moderate, medium, subangular blocky structure; very hard, firm, sticky; common roots; few fine pores; continuous clay films on ped surfaces; calcareous; moderately alkaline; clear, smooth boundary.

B22t—16 to 29 inches, reddish-brown (5YR 5/4) clay, reddish brown (5YR 4/4) when moist; moderate, medium, blocky structure; very hard, firm, very sticky and plastic; thin continuous clay films; few concretions of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B23t—29 to 44 inches, yellowish-red (5YR 5/6) clay loam, yellowish red (5YR 4/6) when moist; moderate, medium, subangular blocky structure; very hard, firm, sticky; few clay films; few films, threads, and weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B24tca—44 to 60 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; many, visible, weakly cemented concretions and soft masses of calcium carbonate make up about 30 percent, by volume, of the horizon; calcareous; moderately alkaline; gradual, wavy boundary.

B25t—60 to 80 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; few clay films; common, visible, soft masses of calcium carbonate make up about 20 percent, by volume, of the horizon; calcareous; moderately alkaline.

The A horizon is brown or reddish brown and ranges from 6 to 8 inches in thickness. The upper part of the Bt horizon is reddish-brown or yellowish-red clay loam or clay that is 35 to 45 percent clay. Structure is moderate, medium, subangular blocky to blocky. The Btca horizon is at a depth of 30 to 60 inches and is pink or reddish yellow. Visible soft masses and weakly cemented concretions of calcium carbonate make up 20 to 50 percent, by volume, of this horizon. The lower part of the Bt horizon is red or reddish yellow.

Olton clay loam, 0 to 1 percent slopes (OcA).—This soil is on smooth uplands. The areas are irregular in shape and range from 20 acres to several hundred acres in size. Slopes are convex and range mainly from 0.4 to 1 percent. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Rowena, Rotan, Stamford, Posey, Acuff, Estacado, Weymouth, and Vernon soils and Olton clay loam, 1 to 3 percent slopes.

The hazards of soil blowing and water erosion are slight.

About 25 to 35 percent of the acreage of this soil is cultivated. The rest is used for range. Capability units IIIe–1, dryland, and I–1, irrigated; Deep Hardland range site.

Olton clay loam, 1 to 3 percent slopes (OcB).—This soil is on uplands. The areas are irregular in shape and range from 15 acres to several hundred acres in size. Slopes are convex and average about 2 percent.

The surface layer is brown clay loam about 6 inches thick. The next layer extends to a depth of 80 inches. It is reddish-brown calcareous clay in the upper 40 inches, and the lower 34 inches is calcareous reddish-yellow clay loam that contains visible soft masses of calcium carbonate. The visible content of these soft masses is about 20 percent.

Included with this soil in mapping were small areas of Stamford, Weymouth, Vernon, and Estacado soils and Olton clay loam, 0 to 1 percent slopes.

The hazard of soil blowing is slight. The hazard of water erosion is moderate.

Most areas of this soil are used for range. A few areas are cultivated. Capability units IIIe–2, dryland, and IIe–1, irrigated; Deep Hardland range site.

Patricia Series

The Patricia series consists of deep, nearly level to gently sloping and gently undulating soils on uplands. These soils formed in friable loamy outwash and eolian material.

In a representative profile the surface layer is brown fine sandy loam about 8 inches thick. The next layer is friable sandy clay loam that extends to a depth of 84 inches. The upper 7 inches is reddish brown; the next 29 inches is yellowish red; and the lower 40 inches is reddish yellow and contains about 2 percent visible films and threads of calcium carbonate (fig. 9).

These soils are well drained. Runoff is slow. Internal drainage is medium. Permeability is moderate. The hazard of soil blowing is moderate to high. The hazard of water erosion is slight to high.

These soils are used for both range and crops.

Representative profile of Patricia fine sandy loam, 1 to 3 percent slopes, in a cultivated field, 150 feet south of Farm Road 1610 from a point 1.32 miles west of the Borden-Scurry County line marker on Farm Road 1610:

Ap—0 to 8 inches, brown (7.5YR 4/4) fine sandy loam, dark brown (7.5YR 3/4) when moist; weak, fine, granular structure; hard, friable; few fine pores; neutral; abrupt, smooth boundary.

B1—8 to 15 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) when moist; weak, very coarse, prismatic structure parting to weak, fine, subangular blocky; very hard, friable, sticky; many fine pores; neutral; gradual, smooth boundary.

B21t—15 to 26 inches, yellowish-red (5YR 4/6) sandy clay loam, yellowish red (5YR 3/6) when moist; weak, very coarse, prismatic structure parting to weak to moderate, medium, subangular blocky; very hard, friable, sticky; many fine pores; few clay films; mildly alkaline; gradual, smooth boundary.

B22t—26 to 44 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; weak, coarse, prismatic structure parting to weak, fine to medium, subangular blocky; very hard, friable, sticky; many fine pores; few clay films; mildly alkaline; gradual, smooth boundary.

B23t—44 to 72 inches, reddish-yellow (5YR 6/6) sandy clay loam yellowish red (5YR 5/6) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; few fine pores; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B24t—72 to 84 inches, reddish-yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) when moist; weak, fine, subangular blocky structure; friable; few clay films; few soft masses of calcium carbonate make up about 2 percent, by volume, of the horizon; calcareous; moderately alkaline.

Figure 9.—**Profile of Patricia fine sandy loam showing very coarse, prismatic structure beginning at a depth of 8 inches.**

The A horizon ranges from 8 to 20 inches in thickness and is reddish-brown or brown fine sandy loam or loamy fine sand. The B1 horizon ranges from 0 to 11 inches in thickness. The B21t and B22t horizons range from 18 to 39 inches in thickness and are reddish brown or yellowish red. Structure ranges from moderate to very coarse prismatic to weak or moderate, medium, subangular blocky. The B23t horizon is yellowish red or reddish yellow and ranges from 10 to 34 inches in thickness. The B24t horizon is at a depth of 36 to 79 inches and is yellowish red or reddish yellow.

Patricia loamy fine sand, 0 to 3 percent slopes (PaB).—This nearly level to gently undulating soil is on uplands. The areas are irregular in shape and are as large as 700 acres. Slopes average about 2 percent.

The surface layer is brown loamy fine sand about 16 inches thick. The next layer is sandy clay loam about 44 inches thick. It is reddish brown in the upper part and yellowish red in the lower part. Below this is yellowish-red sandy clay loam that reaches to a depth of 65 inches.

Included with this soil in mapping were small areas of Patricia fine sandy loam. Also included were a few small areas of Brownfield soils.

The hazard of soil blowing is high. The hazard of water erosion is slight.

Areas of this soil are used for both range and crops. Capability unit IVe–6, dryland; Sandyland range site.

Patricia fine sandy loam, 1 to 3 percent slopes (PfB).—This soil has convex slopes. Slopes range mainly from 1 to 2.8 percent, but they average about 2 percent. The areas are irregular in shape and range from 20 acres to several hundred acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Amarillo, Patricia, Spade, Veal, and Acuff soils.

The hazards of soil blowing and water erosion are moderate. On the steeper slopes there are a few shallow gullies that are 10 to 16 inches deep and 2 to 12 feet wide. In some cultivated areas, a part of the silt and clay in the plow layer has been removed through soil blowing, and the present plow layer is more sandy than the original surface layer.

About 60 to 70 percent of the acreage of this soil is cultivated. Some areas are irrigated. Capability units IIIe–4, dryland, and IIe–3, irrigated; Sandy Loam range site.

Polar Series

The Polar series consists of gently sloping to steep, loamy and gravelly soils that formed in outwash sediment on uplands. These soils are shallow to very shallow. They occur on narrow ridges and knolls above Triassic materials.

In a representative profile the surface layer is reddish-brown gravelly sandy clay loam, about 9 inches thick, that is about 55 percent gravel. The underlying material is yellowish-red gravelly sandy loam that reaches a depth of 60 inches. This layer is 49 to 70 percent gravel and about 20 percent visible calcium carbonate (fig. 10).

These soils are excessively drained. Runoff is medium to rapid. Drainage is medium. Permeability is moderately rapid. The hazard of water erosion is high.

These soils are used for range.

Representative profile of Polar gravelly sandy clay loam in an area of Polar soils in a pasture 0.5 mile east of a point on a county road 10.5 miles south of the east side of Gail:

A1—0 to 9 inches, reddish-brown (5YR 4/4) gravelly sandy clay loam, dark reddish brown (5YR 3/4) when

Figure 10.—**Profile of Polar gravelly sandy clay loam.**

moist; weak, fine, granular structure; slightly hard, very friable, slightly sticky; common very fine roots; very porous; gravel makes up about 55 percent of the horizon; bottom of some pebbles coated with calcium carbonate; calcareous; moderately alkaline; clear, wavy boundary.

C1ca—9 to 29 inches, yellowish-red (5YR 5/6) gravelly sandy loam, yellowish red (5YR 4/6) when moist; massive; porous; slightly hard, very friable, sticky; few very fine roots in upper part; gravel makes up about 49 percent of the horizon; most pebbles coated with calcium carbonate; films, threads, and coatings of calcium carbonate make up about 15 to 20 percent, by volume, of the horizon; calcareous; moderately alkaline; diffuse, wavy boundary.

C2—29 to 60 inches, yellowish-red (5YR 5/6) very gravelly sandy loam, yellowish red (5YR 4/6) when moist, color changes to reddish yellow (5YR 6/6) at a depth of about 40 inches; massive; very porous; slightly hard, very friable; gravel makes up about 70 percent of the horizon; some pebbles coated with calcium carbonate; about 6 percent calcium carbonate; calcareous; moderately alkaline.

The A horizon is brown or reddish-brown gravelly fine sandy loam or gravelly sandy clay loam and ranges from 7 to 14 inches in thickness. Content of gravel ranges from 35 to 60 percent. The C1ca horizon is yellowish red, reddish-brown, or reddish-yellow gravelly sandy clay loam or very gravelly sandy loam that ranges from 10 to 22 inches in thickness. Content of gravel ranges from 35 to 60 percent. The C2 horizon is at a depth of 24 to 36 inches and is reddish yellow or yellowish red. Content of gravel ranges from 40 to 75 percent.

Polar soils (Po).—These gently sloping to steep soils are on narrow ridges and knolls along the Colorado River and its tributaries. The ridges and knolls are 100 to 800 feet wide. Some of the ridges are divided by small valleys that are 20 to 50 feet lower than the ridges and are 30 to 150 feet wide. Slopes are 2 to 30 percent. The areas are elongated or are irregular in shape and range from 15 to 320 acres in size.

Included with these soils in mapping were small areas of Vernon, Potter, Veal, and Patricia soils.

The hazard of water erosion is high.

Because these soils are too steep and gravelly for cultivation, they are used for range. Capability unit VIs–1, dryland; Gravelly range site.

Posey Series

The Posey series consists of deep, gently sloping soils on uplands. These soils formed in friable loamy outwash and eolian material.

In a representative profile the surface layer is brown calcareous loam about 9 inches thick. The next layer reaches a depth of 80 inches. It is brown calcareous clay loam in the upper 10 inches, and the lower 61 inches is clay loam that is pink in the upper part and reddish yellow in the lower part and contains soft masses and weakly cemented concretions of calcium carbonate. The visible content of these concretions ranges from 20 to 50 percent (fig. 11).

These soils are well drained. Runoff and internal drainage are medium. Permeability is moderate. The hazard of soil blowing is slight. The hazard of water erosion is moderate to high.

These soils are used for both range and crops.

Representative profile of Posey loam, 1 to 3 percent slopes, in a pasture 50 feet north of Farm Road 612 from a point 3.6 miles west of the Borden-Scurry County line marker on Farm Road 612:

A1—0 to 9 inches, brown (7.5YR 4/4) loam, dark brown (7.5YR 3/4) when moist; weak, fine, subangular blocky structure; hard, friable, slightly sticky; many roots; many fine pores; few films and threads of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

B21t—9 to 19 inches, brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) when moist; weak, coarse, prismatic structure parting to weak, fine, subangular blocky; hard, friable, slightly sticky; many fine

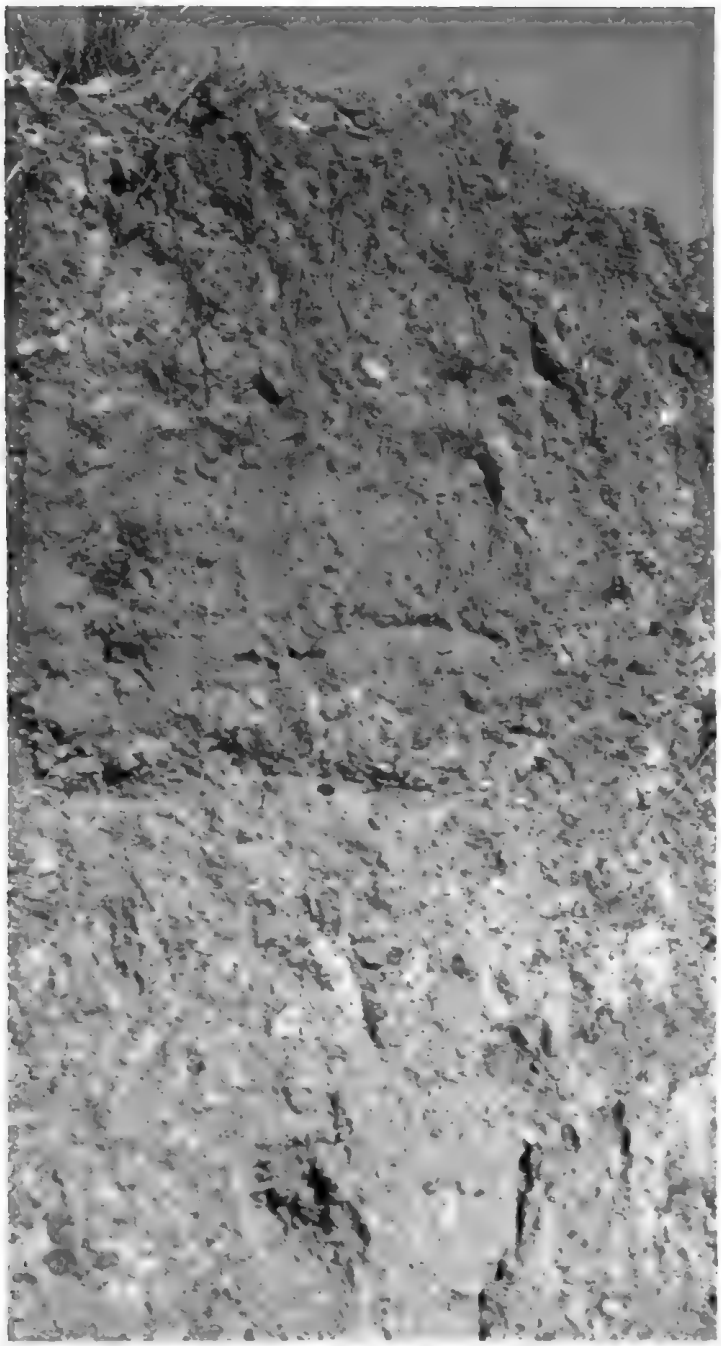

Figure 11.—**Profile of Posey loam showing many soft masses and concretions of calcium carbonate.**

roots; many fine pores; few clay films; common worm casts; fine weakly cemented concretions, soft masses, and films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B22tca—19 to 46 inches, pink (5YR 7/4) clay loam, light reddish brown (5YR 6/4) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; few roots; soft masses and weakly cemented concretions of calcium carbonate make up 50 percent, by volume, of the horizon; calcareous; moderately alkaline; gradual, wavy boundary.

B23tca—46 to 68 inches, reddish-yellow (5YR 7/6) clay loam, reddish yellow (5YR 6/6) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; few clay films; many visible concretions and soft masses of calcium carbonate make up about 30 percent by volume, of the horizon; calcareous; moderately alkaline; gradual, wavy boundary.

B24t—68 to 80 inches, reddish-yellow (5YR 7/6) clay loam, reddish yellow (5YR 6/6) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; few clay films; many visible concretions and soft masses of calcium carbonate make up about 20 percent, by volume, of the horizon; calcareous; moderately alkaline.

The A horizon is brown or reddish-brown loam or clay loam and ranges from 6 to 11 inches in thickness. The B21t horizon is brown or reddish brown and ranges from 5 to 12 inches in thickness. Visible soft masses and weakly cemented concretions of calcium carbonate range from 4 to 10 percent, by volume, of this horizon. The B22tca horizon is at a depth of 12 to 20 inches and is pink or reddish-yellow loam or clay loam. Content of visible soft masses and weakly cemented concretions of calcium carbonate ranges from 15 to 55 percent, by volume, of this horizon. The lower part of the B2t horizon is reddish yellow to yellowish red. Content of visible soft masses and weakly cemented concretions of calcium carbonate ranges from 10 to 30 percent, by volume of this horizon.

Posey loam, 1 to 3 percent slopes (PsB).—This soil has convex slopes. The areas are irregular in shape and range from 15 to 200 acres in size. Slopes average about 2 percent. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Weymouth, Veal, Potter, Colorado, and Spur soils.

The hazard of soil blowing is slight. The hazard of water erosion is moderate. In areas where runoff concentrates, a few shallow gullies occur along intermittent drainageways and on uplands.

Most areas of this soil are used for range. Capability units IIIe–7, dryland, and IIIe–3, irrigated; Deep Hardland range site.

Posey loam, 3 to 5 percent slopes (PsC).—This soil is adjacent to or above small drainageways. The areas are irregular in shape and range from 15 to 100 acres in size. Slopes are convex and average about 4 percent.

The surface layer is brown loam about 8 inches thick. The next layer extends to a depth of 60 inches. It is reddish-brown loam in the upper 8 inches; and the lower 44 inches is loam that is pink in the upper part and reddish yellow in the lower part and contains soft masses and weakly cemented concretions of calcium carbonate. The visible content of these concretions is about 45 percent in the upper part and about 20 percent in the lower part.

Included with this soil in mapping were small areas of Potter, Estacado, and Veal soils and Posey loam, 1 to 3 percent slopes.

The hazard of soil blowing is slight. The hazard of water erosion is high. In areas where water has concentrated, a few shallow gullies and rills occur that are 6 to 16 inches deep and 12 to 80 inches wide.

Most areas of this soil are used for range. A few areas are cultivated. Capability unit IVe–2, dryland; Deep Hardland range site.

Potter Series

The Potter series consists of gently sloping to steep soils on ridges and knolls on uplands. These soils are very shallow to caliche. They formed in thick beds of caliche.

In a representative profile the surface layer is pale-brown loam about 6 inches thick. This layer rests directly on white caliche.

These soils are well drained. Runoff is medium to rapid. Internal drainage is medium. Permeability is moderate. The hazard of water erosion is high.

These soils are used entirely for range.

Representative profile of Potter loam in an area of Potter soils, in a pasture, 100 feet north of Farm Road 1584 from a point 2.65 miles east of the Dawson-Borden County line marker on Farm Road 1584:

A1—0 to 6 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) when moist; weak, fine, granular structure; hard, friable, slightly sticky; few fine pebbles and cemented concretions of calcium carbonate; calcareous; moderately alkaline; abrupt, smooth boundary.

C1ca—6 to 11 inches, white (10YR 8/2) slightly platy caliche; hard, but can be dug with a spade; plates are fractured in places, which allows some roots to penetrate; calcareous; moderately alkaline; clear, wavy boundary.

C2ca—11 to 40 inches, white (10YR 8/2) weakly cemented and powdery caliche that has some hard caliche fragments.

The A horizon is grayish brown or pale brown fine sandy loam to clay loam and ranges from 4 to 10 inches in thickness. The C1ca horizon is at a depth of 4 to 10 inches. It is hard platy caliche that can be dug with a spade. The C2ca horizon is at a depth of 8 to 12 inches. It is weakly cemented caliche to soft caliche beds.

Potter soils (Pt).—These soils are on ridges and knolls on uplands and along natural drainageways. Slopes range from 2 to 30 percent. The areas are elongated or irregular in shape and range from 15 to 700 acres in size. These soils have the profile described as representative for the series, but the surface layer ranges from fine sandy loam to clay loam.

Included with these soils in mapping were small areas of Posey, Kimbrough, Latom, Berda, Veal, Vernon, Polar, and Weymouth soils.

The hazard of water erosion is high.

Areas of these soils are used for range. Capability unit VIIs–1, dryland; Very Shallow range site.

Rotan Series

The Rotan series consists of deep, nearly level to gently sloping soils on uplands. These soils formed in clayey outwash.

In a representative profile the surface layer is dark grayish-brown clay loam about 8 inches thick. In sequence from the top, the next layer is 10 inches of very dark grayish-brown silty clay loam; 24 inches of dark grayish-brown to dark-brown calcareous clay; 16 inches of pink calcareous silty clay loam that is about 30 percent visible soft masses and weakly cemented concretions of calcium carbonate; and 22 inches of reddish-yellow silty clay loam that also contains visible soft masses of calcium carbonate.

These soils are well drained. Runoff and internal drainage are slow. Permeability is moderately slow. The hazard of soil blowing is slight. The hazard of water erosion is slight to moderate.

Most areas of these soils are cultivated. A few areas are in range.

The Rotan soils are mapped only in complexes with Rowena soils.

Representative profile of Rotan clay loam in an area of Rowena-Rotan complex, 0 to 1 percent slopes, in a cultivated field, 0.15 mile north of Farm Road 612 from a point 0.12 mile west of the Borden-Scurry county line marker on Farm Road 612:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; many fine pores; mildly alkaline; abrupt, smooth boundary.

B21t—8 to 18 inches, very dark grayish-brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) when moist; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; common fine pores; thin, almost continuous clay films; mildly alkaline; clear, smooth boundary.

B22t—18 to 30 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) when moist; moderate, medium, subangular blocky structure and weak, fine to medium, blocky; very hard, firm, very sticky and plastic; few very fine pores; thin continuous clay films; calcareous; moderately alkaline; gradual, smooth boundary.

B23t—30 to 42 inches, dark-brown (10YR 4/3) clay, dark brown (10YR 3/3) when moist; moderate, medium, subangular blocky structure and weak, fine to medium, blocky; very hard, firm, sticky and plastic; few clay films; few to common, weakly cemented, visible concretions of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B24tca—42 to 58 inches, pink (7.5YR 8/4) silty clay loam, pink (7.5YR 7/4) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; many, visible, soft masses of calcium carbonate make up about 30 percent, by volume, of the horizon; calcareous; moderately alkaline; gradual, wavy boundary.

B25t—58 to 80 inches, reddish-yellow (7.5YR 7/6) silty clay loam, strong brown (7.5YR 5/6) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; few clay films; common to many, visible, soft masses of calcium carbonate make up about 15 to 20 percent, by volume, of the horizon; calcareous; moderately alkaline.

The A horizon is dark-brown or dark grayish-brown clay loam or silty clay loam and ranges from 6 to 9 inches in thickness. The upper part of the Bt horizon is dark-brown, dark grayish-brown, or very dark grayish-brown clay loam or clay. Reaction is mildly alkaline or moderately alkaline. Structure ranges from moderate, medium, subangular blocky to moderate, medium, blocky. The Btca horizon is at a depth of 30 to 48 inches and is pink or reddish yellow. Soft lumps and weakly cemented concretions of calcium carbonate make up about 20 to 55 percent, by volume, of this horizon. The lower part of the Bt horizon is yellowish red or reddish yellow. Soft lumps of calcium carbonate make up about 6 to 30 percent, by volume, of this horizon.

Rough Broken Land

Rough broken land (Ro) occurs mainly in areas along the escarpment that separates the High Plains from the Rolling Plains. This land type is made up of steep to very steep, rough, broken areas of limestone,

caliche, and clayey red-bed material. It occurs as bands and as irregularly shaped areas that range from 100 acres to several hundred acres in size.

The escarpment consists of limestone. It is nearly vertical in places and ranges from 5 to 90 feet in height. Below the escarpment is an area of caliche material where slopes are 40 to 50 percent. This area is 40 to 200 feet wide and is covered with boulders that have fallen from the escarpment. These boulders are as much as 6 feet in diameter. In places clayey red-bed material that has slopes of 40 to 50 percent is below this area. The area of red-bed material is 60 to 160 feet wide, and in some spots it is covered with boulders 1 to 3 feet in diameter from higher lying areas.

Soil development is limited to a mantle 1 to 3 inches thick that weathered from the underlying material. The hazard of water erosion is high. Erosion has cut large, deep gullies in a few places.

About 10 to 15 percent of the less sloping areas and 55 to 75 percent of the steeper areas of this land type are inaccessible to livestock, particularly to cattle. Vegetation is sparse. About 15 to 35 percent of the less sloping areas are bare, and 40 to 60 percent of the steeper areas are bare. This land type is not arable. Capability unit VIIs–2, dryland; Rough Breaks range site.

Rowena Series

The Rowena series consists of deep, nearly level to gently sloping soils on uplands. These soils formed in clayey outwash.

In a representative profile the surface layer is calcareous dark grayish-brown clay loam about 7 inches thick. The next layer is calcareous clay about 29 inches thick. It is dark grayish brown in the upper part and dark brown in the lower part. The underlying material is calcareous clay loam that reaches to a depth of 80 inches and is pink in the upper part and reddish yellow in the lower part. This layer is about 40 percent visible soft masses and weakly cemented concretions of calcium carbonate.

These soils are well drained. Runoff and internal drainage are slow. Permeability is moderately slow. The hazard of soil blowing is slight. The hazard of water erosion is slight to moderate.

Representative profile of Rowena clay loam in an area of Rowena-Rotan complex, 0 to 1 percent slopes, in a cultivated field, 0.16 mile north of Farm Road 612 from a point 0.12 mile west of the Borden-Scurry county line marker on Farm Road 612:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; few fine pores; calcareous; moderately alkaline; abrupt, smooth boundary.

B21—7 to 14 inches, grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) when moist; moderate, fine to medium, blocky structure; very hard, firm, very sticky; few fine pores; shiny pressure faces on some peds; calcareous; moderately alkaline; clear, smooth boundary.

B22—14 to 36 inches, dark-brown (10YR 4/3) clay, dark brown (10YR 3/3) when moist; moderate, medium, blocky structure; very hard, firm, very sticky; shiny pressure faces on peds; few, fine, weakly cemented calcium carbonate concretions; calcareous; moderately alkaline; clear, wavy boundary.

C1ca—36 to 52 inches, pink (5YR 7/4) clay loam, light reddish brown (5YR 6/4) when moist; massive; hard, friable, very sticky; many, visible, soft masses of calcium carbonate make up about 40 percent, by volume, of the horizon; calcareous; moderately alkaline; gradual, wavy boundary.

C2—52 to 80 inches, reddish-yellow (5YR 7/6) clay loam, reddish yellow (5YR 6/6) when moist; massive; hard, friable, very sticky; many, visible, soft masses of calcium carbonate make up about 15 percent, by volume, of the horizon; calcareous; moderately alkaline.

The A horizon is dark-brown or dark grayish-brown clay loam or silty clay loam and ranges from 5 to 8 inches in thickness. The B2 horizon is dark-brown, dark grayish-brown, or grayish-brown clay loam or clay that is 35 to 50 percent clay. Stucture is weak to moderate, fine to medium, blocky. The C1ca horizon is at a depth of 26 to 40 inches and is pink or yellowish red. Visible soft masses and weakly cemented concretions of calcium carbonate make up about 15 to 40 percent, by volume, of this horizon. The C2 horizon is reddish yellow or yellowish red. Visible soft masses and weakly cemented concretions of calcium carbonate make up about 10 to 25 percent, by volume, of this horizon.

Rowena-Rotan complex, 0 to 1 percent slopes (RrA).—This complex consists of nearly level soils on uplands. The surface layer is clay loam. Rowena soils make up about 62 percent of the complex, Rotan soils about 30 percent, and other soils the remaining 8 percent. These soils are so intricately intermingled that they cannot be separated at the scale mapped. The areas are irregular and circular in shape and range from 30 acres to several hundred acres in size. Slopes range mainly from 0.3 to 1 percent.

Rowena and Rotan soils have the profiles described as representative of their respective series.

Included in this complex in mapping were small areas of Olton, Posey, and Lofton soils and Rowena-Rotan complex, 1 to 3 percent slopes.

The hazards of soil blowing and water erosion are slight.

Most areas of this complex are cultivated. A few areas are used for range. Capability units IIe–2, dryland, and I–1, irrigated; Deep Hardland range site.

Rowena-Rotan complex, 1 to 3 percent slopes (RrB).—This complex consists of soils on uplands. Rowena soils make up about 55 percent of the complex, Rotan soils about 38 percent, and other soils the remaining 7 percent. These soils are so intricately intermingled that they cannot be separated at the scale mapped. The areas are roughly circular and range from 15 to 40 acres in size.

The Rowena soils in this complex have a surface layer of dark grayish-brown clay loam about 6 inches thick. The next layer is calcareous dark-brown clay about 31 inches thick. The underlying material reaches a depth of 80 inches. It is reddish-yellow calcareous clay loam that contains visible soft masses and weakly cemented concretions of calcium carbonate. The visible content of these concretions and masses is about 35 percent.

The Rotan soils in this complex have a surface layer of dark-grayish brown clay loam about 7 inches thick. The next layer reaches a depth of 80 inches. The upper 41 inches is clay that is dark grayish brown in

the upper part and dark brown in the lower part. The lower 32 inches is yellowish-red clay loam that contains visible soft masses and weakly cemented concretions of calcium carbonate. The visible content of these concretions and masses is about 38 percent.

Included with this complex in mapping were small areas of Olton and Posey soils and Rowena-Rotan complex, 0 to 1 percent slopes.

The hazard of soil blowing is slight. The hazard of water erosion is moderate.

Nearly all areas of this complex are cultivated. A few areas are used for range. Capability units IIIe–2, dryland, and IIe–1, irrigated; Deep Hardland range site.

Sharvana Series

The Sharvana series consists of nearly level to gently sloping soils on uplands. These soils are shallow to indurated caliche. They formed in friable loamy material.

In a representative profile the surface layer is reddish-brown fine sandy loam about 7 inches thick. The next layer is a friable reddish-brown sandy clay loam about 11 inches thick that rests abruptly on indurated caliche.

These soils are well drained. Runoff and internal drainage are medium. Permeability is moderate. The hazards of soil blowing and water erosion are moderate.

These soils are used for range and crops.

Representative profile of Sharvana fine sandy loam, 0 to 3 percent slopes, in a cultivated field 0.15 mile west of a county road from a point 1 mile east and 0.55 mile north of the Berry Flat Church:

Ap—0 to 7 inches, reddish-brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) when moist; weak, fine, granular structure; hard, friable, slightly sticky; neutral; abrupt, smooth boundary.

B2t—7 to 18 inches, reddish-brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) when moist; weak, fine to medium, subangular blocky structure; hard, friable, sticky; common pores; few worm casts; few clay films; neutral; abrupt, smooth boundary.

C1cam—18 to 42 inches, white, indurated, platy caliche; smooth, wavy boundary.

C2—42 to 60 inches, pinkish-white (5YR 8/2) loamy earth that has loam texture; platy; weakly cemented caliche; calcareous; moderately alkaline.

The A horizon is reddish brown to brown and ranges from 6 to 8 inches in thickness. Structure ranges from weak granular to weak subangular blocky. The Bt horizon is brown, reddish brown, or red and ranges from 6 to 12 inches in thickness. Structure is weak to moderate, fine to medium, subangular blocky. The C1cam horizon is at a depth of 10 to 20 inches and is 10 to 36 inches thick. The indurated plates range from 1 to 6 inches in thickness. The C2 horizon is at a depth of 20 to 50 inches.

Sharvana fine sandy loam, 0 to 3 percent slopes (SnB).—This soil has convex slopes that range mainly from 0.5 to 2.5 percent. The areas are irregular in shape and range from 166 to 312 acres in size. In some cultivated areas hard caliche fragments are scattered throughout the plow layer.

Included with this soil in mapping were small areas of Kimbrough soils, which generally occur on the top of ridges. Also included were areas of Acuff and Slaughter soils.

The hazards of soil blowing and water erosion are moderate.

Areas of the soil are used for crops and range. Capability units IVs–1, dryland, and IVs–1, irrigated; Sandy Loam range site.

Slaughter Series

The Slaughter series consists of nearly level soils on uplands. These soils are shallow to indurated caliche. They formed in loamy calcareous material.

In a representative profile the surface layer is brown clay loam about 6 inches thick. The next layer is reddish-brown clay loam about 12 inches thick that rests abruptly on indurated caliche.

These soils are well drained. Runoff is slow. Internal drainage is medium. Permeability is moderately slow.

Areas of these soils are used for range and crops.

Slaughter soils are mapped only in a complex with Stegall soils.

Representative profile of Slaughter clay loam in an area of Stegall-Slaughter complex, 0 to 1 percent slopes, in a pasture, 1,200 feet west of Farm Road 1054 from a point 3.65 miles north of intersection of Farm Road 1054 and U.S. Highway 180:

A1—0 to 6 inches, brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) when moist; moderate, fine, subangular blocky structure; hard, friable, sticky; many fine roots; few fine pores; neutral; clear, smooth boundary.

B2t—6 to 18 inches, reddish-brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) when moist; moderate, medium, blocky structure; very hard, firm, very sticky; few fine roots; few fine pores; few thin clay films; mildly alkaline; abrupt, smooth boundary.

Ccam—18 to 26 inches, white indurated caliche.

The A horizon is reddish brown, brown, or dark brown and ranges from 5 to 8 inches in thickness. The B2t horizon is reddish brown or brown and ranges from 6 to 12 inches in thickness. The Ccam horizon is at a depth of 11 to 20 inches. The indurated caliche layer ranges from 6 to 24 inches in thickness and is underlain by softer, more massive caliche several feet thick.

Spade Series

The Spade series consists of moderately deep, gently sloping soils on uplands. These soils formed in loamy sediment over sandstone.

In a representative profile the surface layer is calcareous brown fine sandy loam about 6 inches thick. The next layer is calcareous light-brown fine sandy loam about 20 inches thick and rests abruptly on cemented sandstone.

These soils are well drained. Runoff and internal drainage are medium. Permeability is moderately rapid. The hazards of soil blowing and water erosion are moderate.

Most areas of these soils are used for range.

Representative profile of Spade fine sandy loam in an area of Spade-Latom complex, 2 to 5 percent slopes, in a pasture, 50 feet north of a county road from a

point 1.5 miles south, 2.5 miles west, 1.0 mile south, 1.0 mile west, 1.0 mile south, and 0.6 mile west of Gail:

A1—0 to 6 inches, brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) when moist; weak, fine, granular structure; hard, very friable; many fine roots; many fine pores; calcareous; moderately alkaline; gradual, smooth boundary.

B2—6 to 26 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) when moist; weak, fine, subangular blocky structure; hard, friable; common fine roots; few, fine, weakly cemented concretions, threads, and films of calcium carbonate; calcareous; moderately alkaline; abrupt, smooth boundary.

Rca—26 to 30 inches, light brownish-gray (2.5Y 6/2) weakly cemented sandstone, grayish brown (2.5Y 5/2) when moist; coated with whitish calcium carbonate; calcareous; moderately alkaline.

The A horizon is brown or light brown and ranges from 5 to 12 inches in thickness. The B2 horizon is reddish brown, light brown, or pale brown and ranges from 13 to 30 inches in thickness. In some profiles a ca horizon occurs in the lower part of the B horizon and is 2 to 4 inches thick. Concretions and soft masses of calcium carbonate make up to 2 to 15 percent, by volume, of that horizon. Depth of sandstone ranges from 20 to 40 inches.

Spade-Latom complex, 2 to 5 percent slopes (SlC).—This complex consists of moderately deep Spade soils and shallow to very shallow Latom soils. The soils in this complex are on ridges and along the side slopes of natural drainageways. Spade soils make up about 59 percent of this complex, Latom soils about 37 percent, and other soils the remaining 4 percent. Slopes average about 3.5 percent. The soils in this complex are so intricately intermingled that they cannot be shown separately at the scale mapped. These areas are mostly elongated and are 20 to 100 acres in size.

Spade soils are on the lower three-fourths of areas along natural drainageways and on slopes below the Latom soils on ridgetops. These soils have the profile described as representative for the Spade series.

Latom soils generally are on ridgetops and on the upper one-fourth of areas along natural drainageways. These soils have a surface layer of brown fine sandy loam about 10 inches thick. This layer rests abruptly on strongly cemented sandstone.

Included with this complex in mapping were small areas of Patricia soils and areas of sandstone outcrops.

The hazards of soil blowing and water erosion are moderate.

Nearly all areas of this complex are used for range. Both parts in capability unit VIe–2, dryland; Spade part in Sandy Loam range site and, Latom part in Very Shallow range site.

Spur Series

The Spur series consists of deep, nearly level soils on bottom lands. These soils formed in loamy alluvium.

In a representative profile the surface layer is dark-brown clay loam about 16 inches thick. The next layer is a brown clay loam about 20 inches thick. The underlying material is brown clay loam that extends to a depth of 54 inches.

These soils are well drained. Runoff is slow. Internal drainage is medium. Permeability is moderate.

Most areas of these soils are used for range. A few areas are cultivated.

Representative profile of Spur clay loam, in a pasture, 1.15 miles north of U. S. Highway 180 from a point 3.3 miles west of Gail:

A1—0 to 16 inches, dark-brown (7.5YR 4/2) clay loam; dark brown (7.5YR 3/2) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; many roots; common fine pores; calcareous; moderately alkaline; clear, smooth boundary.

B2—16 to 36 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) when moist; weak, coarse, prismatic structure parting to weak, fine to medium, subangular blocky; hard, friable, sticky; few roots; common fine pores; thin strata of loam and silt loam; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

C—36 to 54 inches, brown (7.5YR 5/4) clay loam, grading to reddish brown (5YR 5/4) with depth; massive; hard, friable, sticky; thin strata of loam and silt loam; few films and threads of calcium carbonate; calcareous; moderately alkaline.

The A horizon is dark brown to dark grayish brown and ranges from 11 to 18 inches in thickness. Structure ranges from weak granular to weak subangular blocky. The B2 horizon is brown to reddish brown and ranges from 15 to 27 inches in thickness. The C horizon is brown to reddish-brown loam or clay loam.

Spur clay loam (Sp).—This soil is on bottom lands along creeks and rivers. The areas are oblong, parallel the drainageways, and range from 30 to 200 acres in size. Slopes range from 0.2 to 0.8 percent.

Included with this soil in mapping were small areas of Mangum, Bippus, and Colorado soils.

The hazards of soil blowing and water erosion are slight.

Areas of this soil are suited to crops, but only a small part is cultivated. Capability units IIe–1, dryland, and I–2, irrigated; Valley range site.

Stamford Series

The Stamford series consists of moderately deep to deep, nearly level to gently sloping soils on uplands. These soils formed in clayey red bed material.

In a representative profile the surface layer is reddish-brown clay about 7 inches thick. The next layer is reddish-brown clay about 21 inches thick. The underlying material is red clay that extends to a depth of 36 inches.

These soils are well drained. Runoff is medium. Internal drainage and permeability are very slow. The hazard of soil blowing is slight. The hazard of water erosion is slight to moderate.

Most areas of these soils are used for range.

Representative profile of Stamford clay, 1 to 3 percent slopes, in a pasture, 50 feet east of Farm Road 669 from a point 1.5 miles south, 2.5 miles west, 3.6 miles south of Gail:

A1—0 to 7 inches, reddish-brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) when moist; weak to moderate, fine, blocky structure; very hard, very firm, very sticky and plastic; few fine roots; few fine pores; calcareous; moderately alkaline; clear, smooth boundary.

AC—7 to 28 inches, reddish-brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) when moist; weak, medium, blocky structure to massive; very hard, very firm, very sticky and plastic; few fine roots; few intersecting slickensides; calcareous; moderately alkaline; gradual, wavy boundary.

C—28 to 36 inches, red (2.5YR 4/6) clay, dark red (2.5YR 3/6) when moist; thin strata of light-gray clay; massive; partly weathered Triassic red-bed material; calcareous; moderately alkaline.

The A horizon is reddish brown or reddish gray and ranges from 6 to 15 inches in thickness. Structure is weak to moderate, fine or medium, blocky or subangular blocky. The AC horizon is red or dark reddish brown and ranges from 20 to 30 inches in thickness. Segregated masses of calcium carbonate appear in the lower part of the AC horizon in places and extend into the C horizon. Content of these masses is as much as 6 percent. The C horizon is red or weak red.

Stamford clay, 0 to 1 percent slopes (StA).—This soil is on uplands. The areas are irregular in shape and range from 20 to 550 acres in size. Slopes range mainly from 0.3 to 1.0 percent but average about 0.6 percent.

The surface layer is reddish-brown clay about 7 inches thick. The next layer is reddish-brown clay about 30 inches thick. The underlying material is red clay.

Included with this soil in mapping were small areas of Vernon, Mangum, and Olton soils and Stamford clay, 1 to 3 percent slopes.

The hazards of soil blowing and water erosion are slight. This soil has a gilgai microrelief made up of enclosed microbasins and microknolls. The areas of gilgai are 2 to 8 inches deep and 6 to 24 inches wide. When this soil is dry, cracks 1 to 2 inches wide and as much as 24 inches deep are common.

Areas of this soil are used for range. Capability unit IIIs–1, dryland; Clay Flats range site.

Stamford clay, 1 to 3 percent slopes (StB).—This soil is on uplands along gently rolling ridges and drainageways. The areas are irregular in shape or elongated and range from 30 acres to several hundred acres in size. Slopes range mainly from 1.3 to 2.8 percent. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Olton, Vernon, and Mangum soils and Stamford clay, 0 to 1 percent slopes.

The hazard of soil blowing is slight. The hazard of water erosion is moderate. In areas where runoff has concentrated, a few gullies 6 to 15 inches deep and 2 to 6 feet wide have formed. When this soil is dry, cracks 1 to 2 inches wide and as much as 24 inches deep are common. This soil has a gilgai microrelief that is made up of enclosed microbasins and microknolls (fig. 12). The areas of gilgai microrelief are 2 to 8 inches deep and 6 to 24 inches wide.

Areas of this soil are used for range. Capability unit IVe–8, dryland; Clay Flats range site.

Stegall Series

The Stegall series consists of nearly level soils on uplands. These soils are moderately deep to indurated caliche. They formed in loamy material.

In a representative profile the surface layer is brown clay loam about 7 inches thick. The next layer is reddish-brown clay loam about 19 inches thick. This layer rests directly on indurated caliche.

Figure 12.—Area of a Stamford clay showing surface cracks and gilgai microrelief.

These soils are well drained. Runoff is slow. Internal drainage is medium. Permeability is moderately slow.

These soils are used for range and crops.

Representative profile of Stegall clay loam in an area of Stegall-Slaughter complex, 0 to 1 percent slopes, in a pasture, 0.5 mile west of Farm Road 1054 from a point 3.65 miles north of intersection of Farm Road 1054 and U. S. Highway 180:

A1—0 to 7 inches, brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; many fine roots; neutral; clear, smooth boundary.

B21t—7 to 15 inches, reddish-brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) when moist; moderate, medium, subangular blocky structure and weak, fine, blocky; very hard, firm, very sticky; common roots; few fine pores; thin clay films; mildly alkaline; clear, smooth boundary.

B22t—15 to 26 inches, reddish-brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) when moist; moderate, fine to medium, blocky structure; very hard, firm, very sticky and plastic; few roots and fine pores; thin continuous clay films; calcareous; moderately alkaline; abrupt, wavy boundary.

Ccam—26 to 30 inches, white, indurated, platy caliche.

The A horizon is brown or dark brown and ranges from 5 to 8 inches in thickness. The Bt horizon is reddish-brown or dark grayish-brown clay loam to clay that is 35 to 45 percent clay. Structure ranges from moderate, medium, subangular blocky to blocky. Depth to the Ccam horizon ranges from 20 to 35 inches. The layer of indurated caliche is 1 to 3 feet thick and is underlain by softer, more massive caliche several feet thick.

Stegall-Slaughter complex, 0 to 1 percent slopes (SuA).—This complex consists of moderately deep Stegall soils and shallow Slaughter soils on uplands. Stegall soils make up about 70 percent of the complex, Slaughter soils about 21 percent, and other soils the remaining 9 percent. The soils in this complex are so intricately intermingled that they cannot be separated at the scale mapped. Slopes range mainly from 0.4 to 1 percent but average about 0.8 percent. The areas of this complex are irregular in shape and are 40 to 250 acres in size.

Included with this complex in mapping were small areas of Olton and Estacado soils.

The hazards of soil blowing and water erosion are slight.

Most areas of this complex are used for range. Capability units IIIe–6, dryland, and I–1, irrigated; Deep Hardland range site.

Veal Series

The Veal series consists of deep, gently sloping soils on uplands. These soils formed in friable, loamy and sandy outwash and eolian material.

In a representative profile the surface layer is brown fine sandy loam about 7 inches thick. The next layer is sandy clay loam that extends to a depth of 66 inches. The upper 11 inches is light brown, and the lower 48 inches is pink and contains soft masses and weakly cemented concretions of calcium carbonate. The underlying material is a reddish-yellow loamy fine sand that reaches a depth of 80 inches.

These soils are well drained. Runoff and internal drainage are medium. Permeability is moderate. The hazard of soil blowing is moderate. The hazard of water erosion is moderate to high.

Areas of these soils are used for range and crops.

Representative profile of Veal fine sandy loam, 1 to 3 percent slopes, in a pasture, 60 feet east of Farm Road 1584 from a point 5.15 miles east, 1.0 mile south, 1.0 mile east, and 0.3 mile south of the Dawson-Borden county line marked on Farm Road 1584:

A1—0 to 7 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) when moist; weak, fine, granular structure; hard, friable, nonsticky; many fine pores; few fine concretions of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

B21—7 to 18 inches, light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) when moist; weak, coarse, prismatic structure parting to weak, fine to medium, subangular blocky; hard, friable, slightly sticky; many fine pores and worm casts; few films and threads of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

B22ca—18 to 38 inches, pink (5YR 8/4) sandy clay loam, pink (5YR 7/4) when moist; weak, fine, subangular blocky structure; hard, friable, slightly sticky; many soft masses and weakly cemented concretions of calcium carbonate make up about 50 percent, by volume, of the horizon; calcareous; moderately alkaline; gradual, wavy boundary.

B23ca—38 to 66 inches, pink (5YR 8/4) sandy clay loam, pink (5YR 7/4) when moist; weak, fine, subangular blocky structure; hard, friable, slightly sticky; many soft masses of calcium carbonate make up about 28 percent, by volume, of the horizon; calcareous; moderately alkaline; gradual, wavy boundary.

C—66 to 80 inches, reddish-yellow (7.5YR 8/6) loamy fine sand, reddish yellow (7.5YR 7/6) when moist; structureless; hard, friable, nonsticky; calcareous; moderately alkaline.

The A horizon is brown or pale-brown loam or fine sandy loam and ranges from 6 to 18 inches in thickness. The B21 horizon is pale-brown or brown fine sandy loam to sandy clay loam and ranges from 5 to 13 inches in thickness. The B22ca horizon is at a depth of 10 to 20 inches and is 12 to 31 inches thick. It is very pale brown or pink fine sandy loam, loam, or clay loam. Soft masses and weakly cemented concretions of calcium carbonate make up about 18 to 60 percent, by volume, of this horizon. The B23ca horizon is at a depth of 26 to 48 inches. This horizon is pink or light reddish brown. Soft masses and weakly cemented concretions of calcium carbonate make up about 10 to 40 percent, by volume, of this horizon. The C horizon is at a depth of 66 to 70 inches. This horizon is fine sandy loam or loamy fine sand.

Veal fine sandy loam, 1 to 3 percent slopes (VaB).—This soil has convex slopes. The areas are irregular in shape and are 10 to 200 acres in size. Slopes average about 2 percent. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Posey, Spade, and Potter soils and Veal fine sandy loam, 3 to 5 percent slopes.

The hazards of soil blowing and water erosion are moderate. In most cultivated areas, part of the silt and clay in the plow layer has been removed by soil blowing and the present plow layer is more sandy than the original surface layer. In areas where runoff has concentrated, a few shallow gullies 6 to 12 inches deep and 12 to 60 inches wide have formed.

Areas of this soil are used for crops and range. Capability units IVe–1, dryland, and IIIe–2, irrigated; Sandy Loam range site.

Veal fine sandy loam, 3 to 5 percent slopes (VaC).—This soil has convex slopes that are mostly along the side slopes of natural drainageways and on ridges on uplands. The areas are elongated or are irregular in shape. They range from 10 to 100 acres in size.

The surface layer is brown fine sandy loam about 6 inches thick. The upper part of the next layer is light-brown sandy clay loam about 10 inches thick. Below this is pink sandy clay loam that contains visible soft masses and weakly cemented concretions of calcium carbonate and reaches to a depth of 67 inches. The visible content of these concretions is about 25 percent.

Included with this soil in mapping were small areas of Spade, Potter, and Mobeetie soils and Veal fine sandy loam, 1 to 3 percent slopes.

The hazard of soil blowing is moderate. The hazard of water erosion is high. In areas where runoff has concentrated, a few shallow gullies 6 to 20 inches deep and 20 to 80 inches wide have formed.

Areas of this soil are used for range. Capability unit IVe–5, dryland; Sandy Loam range site.

Veal-Potter complex, 1 to 8 percent slopes (VbD).—Veal soils make up about 55 percent of this complex, Potter soils about 41 percent, and other soils the remaining 4 percent (fig. 13). The areas are irregular in shape and range from 40 acres to several hundred acres in size.

The gently sloping Veal soils occur between circular areas of Potter soils on knolls and between less sloping areas of Potter soils on ridges. They have a surface layer of brown loam about 8 inches thick. The upper part of the next layer is brown loam about 9 inches thick. Below this and extending to a depth of 64 inches, is loam that contains soft masses and weakly cemented concretions of calcium carbonate. The visible content of these concretions is about 40 percent.

The gently sloping Potter soils occur on small circular knolls and on narrow ridges. They have a surface layer of grayish-brown loam about 5 inches thick. This layer rests on a layer of slightly platy caliche.

Included with these soils in mapping were small areas of Berda, Colorado, Latom, Spur, Olton, and Vernon soils.

All areas of this complex are used as range. The Veal soils are suitable for cultivation, but they are so intricately intermingled with small areas of very shallow Potter soils that cultivation is impractical. Both parts in capability unit VIe–2, dryland; Veal part in Deep Hardland range site, Potter part in Very Shallow range site.

Vernon Series

The Vernon series consists of gently sloping to steep soils on uplands. These soils are moderately deep. They formed in red-bed clayey materials.

In a representative profile the surface layer is reddish-brown clay about 6 inches thick. The next layer is reddish-brown clay about 17 inches thick. The underlying material is red clay that reaches a depth of more than 60 inches.

These soils are well drained. Runoff is rapid. Internal drainage is medium. Permeability is very slow. The hazard of soil blowing is slight. The hazard of water erosion is moderate to high.

Figure 13.—**An area of Veal-Potter complex, 1 to 8 percent slopes.**

Most areas of these soils are used for range.

Representative profile of Vernon clay, 1 to 3 percent slopes, in a pasture, 275 feet west of a county road from a point 12.2 miles south of Texas Highway 180, about 12.5 miles west of Gail:

A1—0 to 6 inches, reddish-brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) when moist; moderate, fine to medium, blocky structure; very hard, very firm, very sticky and plastic; few very fine roots; calcareous; moderately alkaline; gradual, smooth boundary.

B2—6 to 23 inches, reddish-brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) when moist; moderate, medium, blocky structure; very hard, very firm, very sticky and plastic; few very fine roots; few fine calcium carbonate concretions; calcareous; moderately alkaline; clear, smooth boundary.

C—23 to 60 inches, red (2.5YR 4/6) clay, dark red (2.5YR 3/6) when moist; massive; partly weathered red-bed material; calcareous; moderately alkaline. Road cuts show that the thickness of this material is 6 to 10 feet or more.

The A horizon is red or reddish-brown clay loam or clay and ranges from 4 to 8 inches in thickness. The B horizon is reddish-brown or red clay loam or clay and ranges from 12 to 21 inches in thickness. The C horizon is at a depth of 20 to 30 inches. This horizon is red or reddish brown.

Vernon clay, 1 to 3 percent slopes (VcB).—This soil is on uplands along the side slopes of drainageways and on narrow ridges and hilltops in areas of deeper soils on uplands. Slopes average about 2 percent. The areas are irregular in shape or oblong and range from 20 to 200 acres in size. This soil has the profile described as representative for the series.

Included with the soil in mapping were small areas of Stamford and Weymouth soils and Vernon clay, 3 to 12 percent slopes.

The hazard of water erosion is moderate. In areas where runoff has concentrated, a few shallow gullies 4 to 10 inches deep and 1 to 4 feet wide have formed.

Areas of this soil are used for range. Capability unit IVe–3, dryland; Shallow Redland range site.

Vernon clay, 3 to 12 percent slopes (VcE).—This soil is on uplands. It occurs along the side slopes of drainageways and on sloping ridges in areas of deeper soils. The slopes average about 5 percent. The areas are elongated or are irregular in shape and range from 20 to 400 acres in size.

The surface layer is reddish-brown clay about 5 inches thick. The next layer is reddish-brown clay about 17 inches thick. The underlying material is red clay that reaches to a depth of 60 inches.

Included with this soil in mapping were small areas of Weymouth, Stamford, and Polar soils and Vernon clay, 1 to 3 percent slopes.

The hazard of water erosion is high. In areas where runoff has concentrated, few, small, U-shaped gullies 6 to 18 inches deep and 1 to 4 feet wide have formed.

Areas of this soil are used for range. Capability unit VIe–1, dryland; Shallow Redland range site.

Vernon-Badland complex (Ve).—This complex consists of areas of Vernon soils and Badland that are so intricately intermingled that they cannot be separated at the scale mapped. Vernon clay makes up 47 percent of the complex, Badland about 44 percent, and other soils the remaining 9 percent. Areas of this complex occur along drainageways and intermittent streams. The areas are irregular in shape and range from 20 to 200 acres in size.

The Vernon soils have slopes of 2 to 6 percent. They have a surface layer of reddish-brown clay about 5 inches thick. The next layer is reddish-brown clay about 15 inches thick. The underlying material is red clay that reaches a depth of 60 inches.

Badland occurs as erosion scarps and eroded areas of clayey red beds. Slopes range from 2 to 30 percent. This land type is red Triassic red-bed clays that are eroded.

Included with this complex in mapping were small areas of Stamford and Latom soils.

The hazard of water erosion is high. In many areas there are few to many shallow gullies. Erosion of Badland is mostly geologic and is active; soil is lost by erosion almost as fast as it is formed.

Most areas of this complex are used for range and are not suited to cultivation. Although Vernon soils are 5 to 15 percent bare ground, they have a fair to good cover of grass. Badland is 75 to 95 percent bare ground and grows only a scant amount of grass. Capability unit VIs–1, dryland; Shallow Redland range site.

Vernon-Potter complex, 2 to 30 percent slopes (VpF).—This complex consists of gently sloping to steep Vernon soils and gently sloping to sloping Potter soils. Vernon clay makes up 56 percent of the complex, Potter soils about 40 percent, and included soils the remaining 4 percent. The areas are oval or are irregular in shape and range from 20 to 700 acres in size.

The Vernon soils are on side slopes below the Potter soils. They are reddish-brown clay that extends to a depth of 60 inches.

The Potter soils are on scarps and hilltops that are about 50 to 400 feet wide. These soils have a surface layer of grayish brown loam about 7 inches thick. This layer rests abruptly on platy caliche. In some places caliche rocks or fragments and gravel of higher Potter soils have moved downward and have been deposited on the surface of Vernon soils.

Included with this complex in mapping were small areas of Latom and Polar soils and Badland.

The hazard of water erosion is high. Along some of the intermittent drainageways, a few shallow gullies 1 foot to 2 feet deep and 2 to 4 feet wide have formed.

Areas of this complex are used for range. Both parts in capability unit VIs–1, dryland; Vernon part in Shallow Redland range site, Potter part in Very Shallow range site.

Weymouth Series

The Weymouth series consists of moderately deep, gently sloping soils on uplands. These soils formed in loamy red-bed material.

In a representative profile the surface layer is reddish-brown clay loam about 8 inches thick. The next layer is clay loam that extends to a depth of 36 inches. It is yellowish red in the upper 10 inches and reddish yellow in the lower 18 inches. The lower part of this layer is about 20 percent visible soft masses and

weakly cemented concretions of calcium carbonate. The underlying material is red clay that reaches a depth of 60 inches.

These soils are well drained. Runoff and internal drainage are medium. Permeability is moderately slow. The hazard of water erosion is moderate.

Most areas of these soils are used for range.

Representative profile of Weymouth clay loam in an area of Weymouth-Vernon complex, 1 to 3 percent slopes, in a pasture, 50 feet north and 250 feet east of an old road from a point 5.6 miles north of intersection of Farm Road 669 and U.S Highway 180 at Gail:

A1—0 to 8 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; many fine roots and pores; few weakly cemented calcium carbonate concretions on surface; calcareous; moderately alkaline; clear, smooth boundary.

B2—8 to 18 inches, yellowish-red (5YR 5/6) clay loam, yellowish red (5YR 4/6) when moist; moderate, fine to medium, subangular blocky structure; hard, friable, sticky; common fine pores and worm casts; few, fine, weakly cemented concretions and films and threads of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

B3ca—18 to 36 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) when moist; weak, fine, subangular blocky structure; hard, friable, sticky; common to many weakly cemented concretions and soft masses of calcium carbonate make up about 20 percent, by volume, of the horizon; calcareous; moderately alkaline; clear, wavy boundary.

C—36 to 60 inches, red (2.5YR 4/6) clay, dark red (2.5YR 3/6) when moist; massive; partly weathered redbed material that contains few soft masses of calcium carbonate; calcareous; moderately alkaline.

The A horizon is brown or reddish brown and ranges from 5 to 8 inches in thickness. The B2 horizon is reddish brown or yellowish red and ranges from 7 to 15 inches in thickness. The B3ca horizon is reddish yellow or red and is at a depth of 14 to 20 inches. This horizon ranges from 10 to 20 inches in thickness. The C horizon is red or reddish brown and is at a depth of 24 to 40 inches.

Weymouth-Vernon complex, 1 to 3 percent slopes (WvB).—This complex consists of soils on the side slopes of drainageways and on narrow ridges in areas of deeper soils on uplands. Weymouth soils make up about 50 percent of the complex, Vernon soils about 42 percent, and other soils the remaining 8 percent. The soils in this complex are so intricately intermingled that they cannot be separated at the scale mapped. Slopes average about 2 percent. The areas of this complex are oblong or are irregular in shape and range from 15 acres to several hundred acres in size.

The Weymouth soils occur on the top of ridges. They have the profile described as representative for the Weymouth series.

The Vernon soils occur on the sides of the ridges. They have a surface layer of reddish-brown clay loam about 7 inches thick. The next layer is reddish-brown clay about 15 inches thick. The underlying material is red clay that reaches a depth of 60 inches.

Included with this complex in mapping were small areas of Vernon clay and Posey and Olton soils.

The hazard of soil blowing is slight. The hazard of water erosion is moderate. In areas where runoff has concentrated, a few shallow gullies have formed.

Most areas of this complex are used for range. A few areas are used for crops. Capability unit IVe–7, dryland; Shallow Redland range site.

Use and Management of the Soils

This section explains the capability classification used by the Soil Conservation Service and discusses the management of the soils by capability units. Then it gives estimated crop yields on different soils and briefly describes irrigation in the county. It also discusses range management, wildlife, and engineering uses of soils.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most field crops. The soils are grouped according to the limitations when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not consider major and generally expensive land-forming that would change slope, depth, or other characteristics of the soils, and it does not take into consideration . possible but unlikely major reclamation projects.

Those familiar with the capability classification can infer much from it about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for wildlife, or for engineering.

In the capability system, the kinds of soils are grouped at three levels, the capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that

restrict their use largely to pasture, range, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plants cover is maintained; *w* shows that water in or on the soil interfers with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in some parts of the United States, but not in Borden County, shows that the chief limitation is climate that is too cold or too dry.

In Class I there are no subclasses because the soils of this class have few limitations. Class V can contain, at the most, only the subclass indicated by *w*, *s*, and *c*, because the soils in Class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–4, Irrigated, or IIIe–6, Dryland. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraphs; and the Arabic numeral specifically identifies the capability unit within each subclass.

Management by capability units [2]

In the following pages the capability units in Borden County are discussed and suggestions for the use and management of the soils in the county are given.

CAPABILITY UNIT I–1, IRRIGATED

This unit consists of deep to shallow, nearly level, well-drained soils that have a surface layer of clay loam.

Permeability is moderately slow. The hazards of water erosion and soil blowing are slight.

These soils are suited to intensive farming. Cotton and grain sorghum are the main crops.

Cropping systems that include fertilized sorghum or small grain and that include good residue management are needed to help maintain tilth, control erosion, and conserve moisture. If these soils are irrigated, nitrogen fertilizer is needed. An irrigation system that is designed to apply water according to the needs of crops and to prevent soil and water losses is needed. These soils are suited to sprinkler or surface irrigation systems.

CAPABILITY UNIT I–2, IRRIGATED

This unit consists of deep, nearly level, well-drained soils that have a surface layer of loam or clay loam.

Permeability is moderate. The hazard of soil blowing is slight.

These soils are well suited to cultivation. Cotton and grain sorghum are the main crops.

Cropping systems that include fertilized sorghum or small grain and that include good residue management help to maintain tilth, control erosion, and conserve moisture. If these soils are irrigated, nitrogen fertilizer is needed. An irrigation system that is designed to apply water according to the needs of crops and to prevent soil and water losses is needed. These soils are suited to sprinkler or surface irrigation systems.

CAPABILITY UNIT IIe–1, IRRIGATED

This consists of deep, gently sloping, well-drained soils that have a surface layer of clay loam.

Permeability is moderately slow. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

If these soils are protected from erosion, they are suited to intensive cultivation. Cotton and grain sorghums are the main crops.

Fertilized sorghum helps to maintain tilth. Nitrogen fertilizer is needed, and phosphorus is beneficial in places. Returning crop residue to the soil helps to control soil blowing and water erosion. In places, diversion terraces and grassed waterways are needed to remove excess runoff. An irrigation system that is designed to apply water according to the needs of crops and to prevent soil and water losses is needed. These soils are suited to sprinkler or surface irrigation systems.

CAPABILITY UNIT IIe–1, DRYLAND

Only Spur clay loam is in this unit. This is a deep, nearly level, well-drained soil.

Permeability is moderate. The hazard of soil blowing is slight.

This soil is suited to cultivation. Cotton and grain sorghum are the main crops.

Returning crop residue to the soil helps to control soil blowing and water erosion and to maintain tilth. When the soil is inadequately protected by crop growth and residue management, emergency tillage is necessary to roughen the plow layer and thus reduce soil blowing.

CAPABILITY UNIT IIe–2, IRRIGATED

This unit consists of deep, gently sloping, well-drained soils that have a surface layer of loam or clay loam.

Permeability is moderate. The hazard of soil blowing is slight, and the hazard of water erosion is moderate.

[2] By DOUGLAS R. LOWE, conservation agronomist, Soil Conservation Service.

If these soils are protected from erosion, they are suited to intensive cultivation. Cotton and grain sorghum are the main crops.

Fertilized sorghum in the rotation helps to maintain tilth. Nitrogen fertilizer is needed, and phophorus is beneficial in places. Returning crop residue to the soil helps to control soil blowing and water erosion. In places, diversion terraces and grassed waterways are needed to remove excess runoff and control water erosion. An irrigation system that is designed to apply water according to the requirements of the crops and to prevent soil and water losses is needed. These soils are suited to sprinkler or surface irrigation systems.

CAPABILITY UNIT IIe–2, DRYLAND

This unit consists of deep, nearly level, well-drained soils that have a surface layer of clay loam.

Permeability is moderate to moderately slow.

These soils are used for range and crops. They are suited to intensive cultivation. Cotton and grain sorghum are the main crops.

Returning crop residue to the soil helps to control soil blowing and water erosion, conserve moisture, and maintain tilth. If crop growth and residue do not provide adequate protection, emergency tillage is necessary to roughen the plow layer and thus reduce soil blowing.

CAPABILITY UNIT IIe–3, IRRIGATED

This unit consists of deep, gently sloping, well-drained soils that have a surface layer of fine sandy loam.

Permeability is moderate. The hazards of soil blowing and water erosion are moderate.

These soils are suited to cultivation. Cotton and grain sorghum are the main crops.

Fertilized sorghum in the rotation helps to maintain tilth. Nitrogen fertilizer is needed, and phosphorus is beneficial. Returning crop residue to the soil helps to control soil blowing and water erosion. Diversion terraces and grassed waterways are needed in some areas to control water erosion and to remove excess runoff. An irrigation system that is designed to apply water according to requirements of the crops and to prevent soil and water losses is needed. These soils are suited to sprinkler or surface irrigation systems.

CAPABILITY UNIT IIe–4, IRRIGATED

Only Amarillo fine sandy loam, 0 to 1 percent slopes, is in this unit. This soil is deep and well drained.

Permeability is moderate. The hazard of soil blowing is moderate.

This soil is suited to intensive cultivation. Cotton and grain sorghum are the main crops.

If the soil is irrigated, nitrogen fertilizer is needed and phosphorus is beneficial in places. Returning crop residue to the soil helps to control soil blowing and water erosion. Diversion terraces and grassed waterways are needed in places to remove excess water. An irrigation system that is designed to apply water according to the requirements of the crops and to prevent soil and water losses is needed. These soils are suited to sprinkler or surface irrigation systems.

CAPABILITY UNIT IIe–1, IRRIGATED

Only Lofton clay loam is in this unit. This soil is deep, nearly level, and moderately well drained.

Permeability is very slow. The hazard of soil blowing is slight.

Cropping systems that include fertilized sorghums or small grain are needed. Cotton and grain sorghum are the main crops. Returning crop residue to the soil helps to maintain productivity, control erosion, and conserve moisture. If this soil is irrigated, nitrogen is needed more than other fertilizing elements. An irrigation system that is designed to apply water according to the requirements of the crop and to prevent soil and water losses is needed. This soil is suited to a surface irrigation system.

CAPABILITY UNIT IIIe–1, IRRIGATED

Only Amarillo fine sandy loam, 3 to 5 percent slopes, is in this unit. This soil is deep and well drained.

Permeability is moderate. The hazard of soil blowing is moderate, and the hazard of water erosion is high.

This soil is suited to only limited cultivation, because of the high hazard of water erosion. Winter wheat and sorghum are the main crops.

Returning crop residue to the soil helps to control soil blowing and water erosion. If crop growth and residue management do not provide adequate protection, emergency tillage is needed to roughen the plow layer and thus reduce soil blowing. Diversion terraces and grassed waterways are needed to remove excess water. An irrigation system that is designed to apply water according to the requirements of the crops and to prevent soil and water losses is needed. This soil is suited to sprinkler irrigation systems.

CAPABILITY UNIT IIIe–1, DRYLAND

This unit consists of deep, nearly level, well-drained soils that have a surface layer of loam or clay loam.

Permeability is moderate to moderately slow. The hazard of soil blowing is slight.

These soils are used for both crops and range. They are suited to intensive cultivation. Cotton and grain sorghum are the main crops.

Returning crop residue to the soil helps to control soil blowing and water erosion, conserve moisture, and maintain tilth. If crop residue management does not provide adequate protection, emergency tillage is necessary to roughen the plow layer and thus reduce soil blowing.

CAPABLITY UNIT IIIe–2, IRRIGATED

This unit consists of deep, well-drained, gently sloping soils that have a surface layer of fine sandy loam and loam.

Permeability is moderate. The hazard of water erosion is moderate, and the hazard of soil blowing is slight to moderate.

Sorghum is the main crop.

Returning large quantities of crop residue to the soils is important. Some residue should be left on or near the surface, however, to help to control erosion and maintain tilth. Nitrogen fertilizer is needed, and phosphate is beneficial in places. In places, diversion terraces and grassed waterways are needed to remove excess water. Terracing and contour farming are needed on the steep slopes. An irrigation system that is designed to apply water according to the requirements of the crops and to prevent soil and water losses is needed. These soils are suited to sprinkler irrigation systems.

CAPABILITY UNIT IIIe–2, DRYLAND

This unit consists of deep, well-drained, gently sloping soils that have a surface layer of clay loam.

Permeability is moderately slow to moderate. The hazard of water erosion is moderate.

These soils are used for both crops and range. Cotton and grain sorghum are the main crops.

Returning crop residue to the soil helps to control water erosion and soil blowing and to conserve moisture. If crop growth and residue management do not provide adequate protection, emergency tillage is needed to roughen the plow layer and thus reduce soil blowing. Diversion terraces and grassed waterways are needed to remove excess water.

CAPABILITY UNIT IIIe–3, DRYLAND

This unit consists of deep, gently sloping, well-drained soils that have a surface layer of loam and clay loam.

Permeability is moderate. The hazard of soil blowing is slight, and the hazard of water erosion is moderate.

Most areas of these soils are used for range. However, the few areas that are in crops are suitable for intensive farming if the soils are protected from erosion. Cotton and grain sorghum are the main crops.

Returning crop residue to the soil helps to control soil blowing and water erosion and to conserve moisture. Terraces help to control water erosion. Grassed waterways and diversion terraces are needed to remove excess runoff.

CAPABILITY UNIT IIIe–4, DRYLAND

This unit consists of deep, nearly level to gently sloping, well-drained soils that have a surface layer of fine sandy loam.

Permeability is moderate. The hazard of water erosion is slight to moderate, and the hazard of soil blowing is moderate.

These soils are used for both crops and range. If the soils are protected from erosion, they are suited to most crops. Cotton and grain sorghum are the main crops.

Returning crop residue to the soil helps to control soil blowing and water erosion, conserve moisture, and maintain tilth. If crop growth and residue management do not provide adequate protection, emergency tillage is needed to help to control soil blowing. Contour farming and terracing are needed. Diversion terraces and grassed waterways help to remove excess runoff.

CAPABILITY UNIT IIIe–5, DRYLAND

Only Lofton clay loam is in this unit. This soil is deep, moderately well drained, and nearly level.

Permeability is very slow.

This soil is used for range and crops. It is suited to intensive cultivation. Cotton and grain sorghum are the main crops.

Returning the crop residue to the soil helps to control soil blowing and water erosion, conserve moisture, and maintain tilth. If crop growth and residue management do not provide adequate protection, emergency tillage is needed to roughen the plow layer and thus reduce soil blowing.

CAPABILITY UNIT IIIe–6, DRYLAND

Only Stegall-Slaughter complex, 0 to 1 percent slopes, is in this unit. These soils are moderately deep to shallow and well-drained.

Permeability is moderately slow.

These soils are used for range and crops. They are suited to intensive cultivation. Cotton and grain sorghum are the main crops.

Returning crop residue to the soils helps to control soil blowing and water erosion, conserve moisture, and maintain tilth. If crop growth and residue management do not provide adequate protection, emergency tillage is needed to roughen the plow layer and thus reduce soil blowing.

CAPABILITY UNIT IIIe–7, DRYLAND

This unit consists of deep, well-drained, gently sloping soils that have a surface layer of loam.

Permeability is moderate. The hazard of soil blowing is slight, and the hazard of water erosion is moderate.

These soils are used for range and crops. Sorghum is the main crop.

Returning crop residue to the soils helps to control water erosion and soil blowing, conserve moisture, and maintain tilth. If crop residue management does not provide adequate protection, emergency tillage is needed to roughen the plow layer and thus reduce soil blowing. Contour farming and terracing are needed. Diversion terraces and grassed waterways are needed in places to remove excess runoff.

CAPABILITY UNIT IIIe–8, DRYLAND

Only Mobeetie fine sandy loam, 1 to 3 percent slopes, is in this unit. This soil is deep and well-drained.

Permeability is moderately rapid. The hazards of soil blowing and water erosion are moderate.

This soil is used for crops and range. If the soil is protected from erosion, it is suited to cultivation. Cotton and sorghum are the main crops.

Returning crop residue to the soil helps to control water erosion and soil blowing, maintain tilth, and conserve moisture. If crop residue management does not provide adequate protection, emergency tillage is necessary to roughen the plow layer and thus reduce soil blowing. Contour farming and terracing are needed on this soil. Diversion terraces and grassed waterways are needed to remove excess runoff.

CAPABILITY UNIT IIIs–1, DRYLAND

This unit consists of deep to moderately deep, nearly level, well-drained clayey soils.

Permeability is very slow. The hazards of water erosion and soil blowing are slight.

Most areas of these soils are used for range. The main crop is small grain.

Returning crop residue to the soils helps to conserve moisture, control erosion, and maintain tilth. If crop growth and residue management do not provide adequate protective cover, emergency tillage is necessary to roughen the plow layer and thus reduce soil blowing.

CAPABILITY UNIT IVe–1, DRYLAND

Only Veal fine sandy loam, 1 to 3 percent slopes, is in this unit. This soil is deep and well drained.

Permeability is moderate. The hazards of soil blowing and water erosion are moderate.

This soil is used for crops and range. The main crops are cotton and sorghum.

Returning crop residue to the soil helps to control water erosion and soil blowing, maintain tilth, and conserve moisture. If crop residue management does not provide adequate protection, emergency tillage is needed to roughen the plow layer and thus reduce soil blowing. Contour farming and terraces are needed on this soil. Diversion terraces and grassed waterways help to remove excess runoff.

CAPABILITY UNIT IVe–2, DRYLAND

This unit consists of deep, well-drained, gently sloping, loamy soils.

Permeability is moderate. The hazard of water erosion is high.

These soils are used for range. They are not well suited for cultivation. If they are cultivated, however, the soils are better suited to small grain or sorghum than to most other crops.

Returning crop residue to the soils helps to control soil blowing and water erosion. Terraces and grassed waterways are needed to remove excess runoff.

CAPABILITY UNIT IVe–3, DRYLAND

Only Arch loam, 0 to 3 percent slopes, is in this unit. This soil is well drained.

Permeability is moderate. The hazard of soil blowing is slight.

This soil is used for range. It is not well suited to cultivation. Grain sorghum or small grain, however, may be grown under careful management. This soil is better suited to permanent vegetation.

Returning crop residue to the soil helps to control soil blowing and maintain tilth. The high content of lime in this soil tends to tie up plant food. Yellowing of sorghum is common. Nitrogen fertilizer increases plant growth and production.

CAPABILITY UNIT IVe–4, DRYLAND

Only Amarillo fine sandy loam, 3 to 5 percent slopes, is in this unit. This soil is deep and well drained.

Permeability is moderate. The hazard of soil blowing is moderate, and the hazard of water erosion is high.

This soil is used for both range and crops. Small grain and sorghum are the main crops.

Returning crop residue to the soil helps to control soil blowing and water erosion. Terraces and grassed waterways are needed to remove excess runoff.

CAPABILITY UNIT IVe–5, DRYLAND

Only Veal fine sandy loam, 3 to 5 percent slopes, is in this unit. This soil is deep, and well-drained.

Permeability is moderate. The hazard of soil blowing is moderate, and the hazard of water erosion is high.

This soil is used for range. It is not well suited to cultivation. If the soil is cultivated, however, it is better suited to small grain or sorghum than to most other crops.

Returning crop residue to the soil helps to control soil blowing and water erosion. Terraces and grassed waterways are needed to remove excess runoff.

CAPABILITY UNIT IVe–6, DRYLAND

Only Patricia loamy fine sand, 0 to 3 percent slopes, is in this unit. This soil is deep and well drained.

Permeability is moderate. The hazard of soil blowing is high, and the hazard of water erosion is slight.

This soil is used for both range and crops. If the soil is protected from soil blowing, it is suited to limited cultivation. Cotton and sorghum are the main crops.

Returning crop residue to the soil throughout the year helps to control soil blowing. Deep plowing helps to increase the content of clay in the surface layer. If crop residue management does not provide adequate protection, emergency tillage is needed to roughen the plow layer and thus reduce soil blowing. Terraces and grassed waterways help to remove excess runoff.

CAPABILITY UNIT IVe–7, DRYLAND

This unit consists of moderately deep, gently sloping, well-drained soils that have a surface layer of clay loam or clay.

Permeability is moderately slow to very slow. The hazard of water erosion is moderate.

Most areas of these soils are used for range. If the soils are cultivated, the main management needs are to control erosion and conserve moisture. Grain sorghum and small grains are suitable crops.

Returning crop residue to the soils throughout the year helps to control soil blowing and water erosion and to conserve moisture. Terraces and grassed waterways are needed to remove excess water.

CAPABILITY UNIT IVe–8, DRYLAND

Only Stamford clay, 1 to 3 percent slopes, is in this unit. This soil is deep to moderately deep and well drained.

Permeability is very slow. The hazard of water erosion is moderate.

Most areas of this soil are used for range. The soil is not well suited to cultivation, but grain sorghum

and small grain can be grown. This soil tends to be droughty and is better suited to permanent grass vegetation.

Returning crop residue to the soil helps to control soil blowing and water erosion and to maintain tilth. If crop residue management does not provide adequate protection, tillage is needed to roughen the plow layer and thus reduce soil blowing. Terraces and grassed waterways are needed to remove excess runoff.

CAPABILITY UNIT IVw–1, DRYLAND

Only Lipan clay is in this unit. This soil is deep, nearly level, and moderately well drained.

Permeability is very slow.

Most areas of this soil are wet or are under water for periods of as much as several weeks. This soil is therefore suited to only limited cultivation. Small grain and sorghum are the main crops.

Returning crop residue to the soil helps to control soil blowing and maintain tilth.

CAPABILITY UNIT IVs–1, IRRIGATED

Only Sharvana fine sandy loam, 0 to 3 percent slopes, is in this unit. This soil is shallow and well drained.

Permeability is moderate. The hazards of soil blowing and water erosion are moderate.

This soil is not well suited to cultivation. Sorghum is the main crop.

Returning crop residue to the soil helps to control soil blowing and water erosion and to maintain tilth. Nitrogen is needed, and phosphate is also beneficial. Contour farming helps to control water erosion on the steeper slopes. An irrigation system that is designed to apply water according to the requirements of the crops and to prevent soil and water losses is needed. This soil is suited to sprinkler irrigation systems.

CAPABILITY UNIT IVs–1, DRYLAND

Only Sharvana fine sandy loam, 0 to 3 percent slopes, is in this unit. This soil is shallow and well drained.

Permeability is moderate. The hazards of soil blowing and water erosion are moderate.

This soil is used for both range and crops. It is not well suited to cultivation. Sorghum is the main crop.

Returning crop residue to the soil throughout the year helps to control water erosion and maintain tilth. If crop growth and residue management do not provide adequate protection, tillage is needed to roughen the plow layer. Terraces, diversions terraces, and grassed waterways help to control excess runoff.

CAPABILITY UNIT Vw–1, DRYLAND

Only Colorado and Spur soils are in this unit. These soils are deep, well drained, and nearly level.

Permeability is moderate.

These soils are subject to frequent flooding during periods of excess runoff. New materials are deposited on the surface and the soils are subject to slight scouring during the periods of flooding. These soils are better suited to range, wildlife habitat, and recreational uses than to cultivation.

CAPABILITY UNIT VIe–1, DRYLAND

Only Vernon Clay, 3 to 12 percent slopes, is in this unit. This soil is moderately deep, and well drained.

Permeability is very slow. The hazard of water erosion is high.

This soil is not suited to cultivation. It is better suited to range, wildlife habitat, or recreational uses.

CAPABILITY UNIT VIe–2, DRYLAND

This unit consists of very shallow to deep, well-drained, gently sloping to sloping soils.

Permeability is moderate to moderately rapid.

These soils are not suited to cultivation. They are better suited to range, wildlife habitat, or recreational uses.

CAPABILITY UNIT VIe–3, DRYLAND

Only Brownfield fine sand is in this unit. This soil is deep, nearly level to gently undulating, and well drained.

Permeability is moderate.

This soil is not suited to cultivation. It is better suited to range, recreational uses, or wildlife habitat.

CAPABILITY UNIT VIs–1, DRYLAND

This unit consists of very shallow to moderately deep, moderately well drained to excessively drained, gently sloping to steep soils.

Permeability is moderately rapid to very slow.

These soils are not suited to cultivation. They are better suited to range, recreational uses, or wildlife habitat.

CAPABILITY UNIT VIs–2, DRYLAND

Only Mangum clay, channeled, is in this unit. This soil is deep, nearly level, and well drained.

Permeability is very slow.

This soil is subject to frequent flooding during periods of excess runoff. New materials are deposited on the surface and the soil is subject to slight scouring during periods of flooding. This soil is not suited to cultivation. It is better suited to range, wildlife habitat, or recreational uses.

CAPABILITY UNIT VIIs–1, DRYLAND

This unit consists of shallow to very shallow, gently sloping to steep, well-drained soils.

Permeability is moderate. The hazard of water erosion is moderate to high.

These soils are not suited to cultivation. They are better suited to range or wildlife habitat.

CAPABILITY UNIT VIIs–2, DRYLAND

Only Rough broken land is in this unit. This land type occurs along caprock escarpments and in strongly dissected areas.

This land type occurs in small areas at the crest of steep areas and on small benches or shelves above drainageways. The soil material in these areas is deep enough to grow small amounts of forage for grazing. These areas are suited only to range, wildlife habitat, or recreational uses. Many of the steeper areas are inaccessible to livestock.

CAPABILITY UNIT VIIIe-1, DRYLAND

Only Badland is in this unit. This land type consists of gently sloping to very steep, eroded clays.

Areas of Badland are too erodible to produce enough usable forage for range. Vegetation grows only in areas along drainageways or in small spots of included soils. This land type is better suited to wildlife habitat or recreational uses.

Predicted Yields

Crop yields in Bordon County depend on how well the soils are managed. Consistently high yields can be obtained if the soils are used within their capabilities and are managed according to their needs.

Table 2 gives predicted average yields per acres for each soil that is cultivated in the county. The predictions assume a high level of management. These predictions are for cotton and grain sorghum grown without irrigation. The predictions are based on information obtained from farmers and from others familiar with the soils in the county. No yield predictions were made for soils under irrigation; however, yields are considerably higher under irrigation.

A high level of dryland management for the soils in this county consists of—

1. Managing crop residue in a way that effectively controls erosion and protects the soil.
2. Using a cropping system that maintains an adequate supply of organic matter.
3. Conserving rainwater.
4. Maintaining fertility by the timely application of fertilizer and by growing soil-improving crops.
5. Controlling insects, diseases, and weeds.

TABLE 2.—*Predicted average acre yields of principal dryland crops on arable soils*

[Only soils that are suited to, and generally used for, crops are listed]

Soil	Cotton (lint)	Grain sorghum
	Pounds	*Pounds*
Acuff loam, 0 to 1 percent slopes	200	1,250
Acuff loam, 1 to 3 percent slopes	175	1,250
Amarillo fine sandy loam, 0 to 1 percent slopes	200	1,250
Amarillo fine sandy loam, 1 to 3 percent slopes	175	1,000
Amarillo fine sandy loam, 3 to 5 percent slopes	150	800
Estacado clay loam, 0 to 1 percent slopes	200	1,250
Estacado clay loam, 1 to 3 percent slopes	150	1,250
Lipan clay		1,000
Lofton clay loam	190	1,200
Olton clay loam, 0 to 1 percent slopes	200	1,250
Olton clay loam, 1 to 3 percent slopes	185	1,050
Patricia loamy fine sand, 0 to 3 percent slopes	200	1,000
Patricia fine sandy loam, 1 to 3 percent slopes	190	1,000
Posey loam, 1 to 3 percent slopes	150	1,250
Rowena-Rotan complex, 0 to 1 percent slopes	250	1,500
Rowena-Rotan complex, 1 to 3 percent slopes	185	1,250
Sharvana fine sandy loam, 0 to 3 percent slopes	115	600
Stegall-Slaughter complex, 0 to 1 percent slopes	150	900
Veal fine sandy loam, 1 to 3 percent slopes	150	1,000

6. Keeping tillage to a minimum and tilling only when the moisture content is such that compaction is minimized.
7. Planting improved crop varieties.
8. Using terraces and other mechanical aids and maintaining them effectively

Irrigation

Irrigation is a fairly limited practice in Borden County. It is a supplemental practice that is used mainly in periods of drought. About 2,000 to 3,000 acres are irrigated in the county. The northwestern part of the county has most of the irrigated areas.

All water used for irrigation comes from wells that are 200 to 300 feet deep. These wells yield 50 to 500 gallons per minute.

Row irrigation is the principal type of irrigation system and is used on the nearly level, fine-textured and medium-textured soils. In places land leveling is needed before row irrigation can be used. If the soils are irrigated, crop yields are expected to increase to as much as double the amount produced under dryland farming.

Range Management [3]

Ranching is the most important economic enterprise in Borden County. Native grass covers about 84 percent of the county. There are 73 ranching units in the county. They range from 2,000 to 50,000 acres in size. The average size is 3,640 acres.

Crops generally are not used to supplement ranching operations. Therefore, most ranching operations are centered around the production of native grass. However, some forage sorghum is grown for summer grazing.

More than 95 percent of the livestock operations are cow-calf. Winter supplemental feeding is generally heavy. Livestock is fed from December through late February or March. Calves are often sold on a contract basis to northern buyers for delivery late in spring and early in summer.

Many of the soils used for range are clayey, but some are loamy. The clayey soils mainly produce short grasses. A wider variety of vegetation grows on the sandier soils, which produce mid and tall grasses. The sandy loams mainly produce mid grasses and lesser amounts of tall grasses.

The native grasslands have been heavily grazed for several generations. As a result, a high percentage of the more desirable types of grasses and forbs have been grazed out, permitting less desirable grasses, weeds, and brush to invade. The sandy soils frequently produce an abundance of shinnery oak and dropseeds instead of taller grasses. The tighter soils have been invaded by mesquite, and the shallow soils produce an abundance of noxious weeds. However, a close look at all of the sites reveals remnants of the native species. These species generally increase if the grassland is given proper care and treatment.

[3] By JOE B. NORRIS, range conservationist, Soil Conservation Service.

Areas that receive extra water and produce the greatest quantity of grass are along draws, rivers, and creeks.

Range sites and condition classes

A range site is a distinctive kind of rangeland that differs from other kinds of rangeland in its potential to produce native plants.

Range sites differ from each other in their ability to produce significantly different kinds or proportions of plant species or in total annual yield. Significant differences are those great enough to require some variation in management, such as a different rate of stocking.

Differences in environmental factors such as soil, topography, and climate account for the different kinds, proportions, and amounts of plants that the various sites are capable of supporting. Therefore, range sites can be identified by the kinds of soil that are known to be capable of producing the distinctive potential plant community that characterizes a specific site.

Range condition is the present condition of the vegetation of a range site in relation to the potential plant cover for that site. Range condition classes indicate the degree in which the present plant composition resembles that of the potential (climax) plant community of a range site.

Four range condition classes are recognized. This classification is based on the measurements or estimates of the percentage of decreasers and increasers in the present vegetation in comparison with the percentage in the climax vegetation. A range is in *excellent* condition if 75 percent or more of the plants are climax vegetation. It is in *good* condition if the percentage is between 50 and 75, in *fair* condition if the percentage is between 25 and 50, and in *poor* condition if the percentage is 25 or less.

In determining present range condition class, plants are grouped in accordance with their response to the kind of grazing used on specific range sites. These groups of plants are decreasers, increasers, and invaders.

Decreaser plants are species in the climax community that decrease in relative abundance when such a community is subject to continued moderately heavy to heavy grazing use. Most of these kinds of plants have a high grazing preference, and they decrease from excessive use. The total of all such species is counted in determining range condition class.

Increaser plants are species present in the climax community that normally increase in relative abundance when the community is subjected to continued moderately heavy to heavy grazing use. Some increasers of moderately high grazing preference may initially increase and then decrease as grazing pressure continues. Others, of low grazing preference, may continue to increase either in actual numbers or in relative proportions. Only the percentages of increaser plants normally expected to occur in the potential plant community are counted in determining range condition.

Invader plants are not members of the climax community for the site. They invade the community as a result of various kinds of disturbance. They may be annuals or perennials and may be grasses, weeds, or woody plants. Some have relatively high grazing value, but many are worthless. Invader plants are not counted in determining range condition class.

For most range sites and livestock operations, the higher the range condition class, the greater the quality and amount of available forage.

Descriptions of the range sites

There are 12 range sites in Borden County. In the descriptions of the range sites, the soils, composition of the climax plant community, major invaders, and the air-dry herbage yield are discussed. The soils in each range site can be determined by referring to the "Guide to Mapping Units" at the back of the survey.

BOTTOMLAND RANGE SITE

This site consists of nearly level, deep, loamy soils on lowlands in the major draws and small draws, along intermittent streams, and adjacent to the Colorado River.

Available water capacity is high. These soils receive runoff from higher lying soils. Although these soils are subject to flooding, they are under water for only short periods. Damage to vegetation is normally from sedimentation rather than wetness. If this site is in good to excellent condition, it is capable of producing an abundance of mid grasses.

The composition of the climax plant community depends on the depth of the alluvial deposits and the amount of extra water the site receives. The climax plant community generally is 20 percent sand bluestem; 10 percent each little bluestem, indiangrass, side-oats grama, and tobosagrass; 5 percent each switchgrass, Canada wildrye, white tridens, plains bristlegrass, and feathery bluestem; 10 percent western wheatgrass, vine-mesquite, blue grama, buffalograss, and perennial forbs; and 5 percent browse. Trees such as elm, hackberry, and cottonwood are scattered along the banks of major streams.

This site deteriorates rapidly if it is overused for prolonged periods. The first to disappear under heavy grazing are tall grasses such as sand bluestem, indiangrass, and switchgrass. Then mid grasses are replaced by such plants as sand dropseed, three-awn, and perennial broomweed. With the approach of complete deterioration, vegetation is reduced to numerous annuals and dense stands of brush.

This site is productive, and improvement measures can be readily applied. The grasses remain green longer on this site than on others because it receives extra water from runoff. The site responds well to brush control by root plowing or dozing and seeding. Aerial spraying is effective if there is a seed source of desirable vegetation. Extra water on the site makes seeding more successful if flooding is not a concern. Basal treatment of mesquite is effective on open stands.

If this site is in excellent condition, the annual production of air-dry herbage ranges from 1,800 to 2,800

pounds per acre. About two-thirds of this production is suitable forage for livestock and wildlife.

CLAY FLATS RANGE SITE

This site consists of deep, nearly level to gently sloping, clayey soils. These soils are on broad flats.

The soils in this site are droughty, and they crack during long periods of low rainfall. Available water capacity is high. This site produces an abundance of tobosagrass (fig. 14).

The climax community is more stable on this site than on most of the other sites in the survey area. Vegatation has remained about the same over the years. The climax plant community generally is 40 percent tobsagrass, 15 percent blue grama, 15 percent vine-mesquite, 10 percent white tridens, 10 percent buffalograss, and 10 percent perennial forbs.

If the site deteriorates under continued heavy grazing, tobosagrass and buffalograss become dominant. If the site is in poor condition, mesquite, prickly pear, cholla cactus, and annuals invade.

Costly treatments are seldom applied, because the soils are droughty. The use of this site by livestock is limited to spring, because most of the annual production is tobosagrass.

If the site is in excellent condition, the annual production of air-dry herbage ranges from 800 to 2,000 pounds per acre. About 50 percent of this production is suitable forage for livestock.

DEEP HARDLAND RANGE SITE

This site consists of very shallow to deep, mostly smooth, nearly level to gently sloping, loamy soils on upland plains. It is accessible to livestock and is a favorite for grazing.

Permeability is moderate to very slow. Available water capacity is low to high. In places the moisture intake is reduced by surface crusting and the compacted layer, or "hoof pan," caused by trampling. This site produces short to mid grasses (fig. 15).

The climax plant community consists of 15 percent side-oats grama, 15 percent blue grama, 10 percent buffalograss, 10 percent vine-mesquite, 10 percent tobosagrass, 10 percent feathery bluestem, 5 percent western wheatgrass, 5 percent Texas wintergrass, 15 percent Arizona cottontop and plains bristlegrass, and 5 percent perennial forbs.

If this site deteriorates under continued heavy grazing, blue grama decreases and buffalograss increases. Further deterioration of the site brings an invasion of perennial three-awn, hairy tridens, broom snakeweed, and mesquite.

If this site is in poor condition or if rainfall is low in spring, bare spots are occupied by Texas filaree, evax, various plaintains, bladderpod, plains greenthread, bitterweed actinea, annual broomweed, little barley, and other invading annuals. The more common invading perennial forbs on this site are western ragweed, silverleaf nightshade, and Dakota verbena.

Figure 14.—**Tobosagrass in an area of Mangum clay in the Clay Flats range site.**

Figure 15.—**Area of Deep Hardland range site that has a good turf of adapted grasses growing on an Olton clay loam. Invasion of mesquite has resulted from previous abuse of the grassland.**

This site is capable of limited production. A plant cover is necessary to reduce surface crusting and to prevent erosion. Once the range is in poor condition, recovery is very slow because of the lack of seed plants of desirable species, crusted soils, and heavy infestation of mesquite.

If this site is in excellent condition, the annual production of air-dry herbage ranges from 1,200 to 2,200 pounds per acre, depending on the amount of rainfall received. About 85 percent of this production is suitable forage for livestock.

DEEP SAND RANGE SITE

This site consists of deep, nearly level to gently undulating, sandy soils on uplands.

Available water capacity is low. This site produces dominantly tall grasses and lesser amounts of mid grasses.

The climax community is 20 percent sand bluestem, 15 percent little bluestem, 15 percent shinnery oak, 10 percent giant dropseed, 10 percent feathery bluestem, 5 percent indiangrass, 5 percent side-oats grama, 5 percent sand dropseed, 5 percent perennial three-awns, and 10 percent perennial forbs.

Under heavy grazing the site deteriorates rapidly. However, it responds well to good management.

If this site is in excellent condition, the total annual production of air-dry herbage ranges from 1,500 to 3,200 pounds per acre. About two-thirds of this production is suitable forage for livestock and wildlife.

GRAVELLY RANGE SITE

This site consists of shallow to very shallow, gently sloping to sloping, gravelly, loamy soils on hills and knolls.

Available water capacity is low. This site produces a wide variety of vegetation.

The climax plant community generally is 20 percent side-oats grama; 20 percent little bluestem; 10 percent sand bluestem; 10 percent feathery bluestem; 5 percent hairy grama; 5 percent indiangrass; 5 percent shinnery oak; 10 percent catclaw, redberry juniper, and agarito; and 15 percent other perennial grasses.

If this site deteriorates under continued heavy grazing, such plants as Texas grama, sand muhly, hairy tridens, prickly pear, cactus, and annuals invade. Erosion removes the topsoil, and the growth of vegetation is greatly reduced. Many areas have little more than a gravel bed in which to grow grasses.

If the site is in excellent condition, the annual production of air-dry herbage ranges from 1,400 to 2,200 pounds per acre. This variation depends largely on annual rainfall as well as the degree of past erosion. About 60 percent of this production is suitable forage for livestock and wildlife.

HIGH LIME RANGE SITE

This site consists of nearly level to gently sloping, loamy soils that are shallow to white chalky material. These soils are high in free lime.

Available water capacity is high. This site only produces vegetation that is tolerant to lime.

If the site is in average condition, the original climax plant community generally is 40 percent alkali sacaton, 20 percent side-oats grama, 15 percent blue grama, 10 percent black grama, and 5 percent each vine-mesquite, plains bristlegrass, and sand dropseed. Following loss of the original plant cover, broom snakeweed, whorled dropseed, and numerous annuals invade.

If the site is in good or excellent condition, the annual production of air-dry herbage ranges from 1,100 to 1,800 pounds per acre. About 80 percent of this production is suitable forage for livestock and wildlife.

ROUGH BREAKS RANGE SITE

This site consists of steep to very steep, stony and clayey soils. These soils are along the "Cap Rock" (fig. 16), where production of forage and accessibility to livestock are poor.

The climax plant community is 20 percent side-oats grama, 15 percent little bluestem, 10 percent feathery bluestem, 10 percent black grama, 5 percent hairy grama, 5 percent slim tridens, 15 percent dalea, catclaw acacia, and skunkbush sumac, 15 percent other perennial grasses, and 5 percent perennial forbs.

If the site deteriorates under continued heavy grazing, Texas grama, hairy tridens, sand muhly, and numerous annuals invade.

If the site is in excellent condition, the plant cover generally is spare. Under prolonged heavy use, the steep slopes lose all their protective plant cover, which results in a high hazard of erosion and severe soil loss. Intensive management and protective practices must be applied before the site can be stabilized. Overgrazing the site causes severe deterioration of the whole pasture.

If this site is in excellent condition, the annual production of air-dry herbage ranges from 500 to 900 pounds per acre. About 50 percent or less of this production is suitable forage for livestock. Vegetation growing on the steeper slopes is used more by wildlife than by domestic livestock.

SANDYLAND RANGE SITE

This site consists of deep, smooth, nearly level to gently undulating sandy soils.

Available water capacity is high. If properly managed, this site produces good stands of mid and tall grasses.

The climax plant community generally is 15 percent sand bluestem, 15 percent little bluestem, 10 percent side-oats grama, 10 percent giant dropseed, 10 percent shinnery oak, 5 percent indiangrass, 5 percent sand dropseed, 5 percent feathery bluestem, 5 percent hooded windmillgrass, 10 percent fall witchgrass and hairy grama, 5 percent perennial forbs, and 5 percent other perennial grasses.

If this site deteriorates, soapweed (yucca), shinnery oak, and annuals quickly invade. Invading grasses include annual three-awn, fringed signalgrass, tumble windmillgrass, gummy lovegrass, red lovegrass, and tumble lovegrass. The chief invading weeds are tumble ringwing, annual wildbuckwheat, prairie sunflower, woolly-white, beebalm, pricklepoppy, Riddell grounsel, and stillingia.

Shinnery oak must be controlled before grasses can

Figure 16.—**Area of Rough Breaks range site along the "Cap Rock."**

recover. The site responds well to chemical control of undesired plants, but mechanical methods are not feasible, because of the resulting hazard of soil blowing. If a seed source is available and care is good, the site returns to good to excellent condition in a few years. If response is slow, overseeding speeds recovery.

Although this is a high-producing site, production varies widely from year to year and is influenced by the amount of rainfall received annually. If this site is in excellent condition, the annual production of air-dry herbage ranges from 1,200 to 3,000 pounds per acre. About two-thirds of this production is suitable forage for livestock and wildlife.

SANDY LOAM RANGE SITE

This site consists of deep to shallow, nearly level to gently sloping, loamy soils on upland plains.

These soils are well drained. Permeability is moderate to moderately rapid. Available water capacity is low to high. This site is capable of producing a wide variety of vegetation (fig. 17).

The climax plant community is 25 percent blue grama, 15 percent side-oats grama, 15 percent black grama, 10 percent little bluestem, 5 percent Arizona cottontop, 5 percent plains bristlegrass, 5 percent buffalograss, sand dropseed, perennial three-awn, hooded windmillgrass, and fall witchgrass, 10 percent perennial forbs, and 10 percent perennial browse.

If the site deteriorates under continued heavy grazing, mesquite, yucca, and numerous annuals invade.

This site is frequently treated for invasion of brush by both mechanical and chemical methods. Following the use of these controls, the pasture needs rest to permit the recovery of grasses.

If this site is in excellent condition, the annual production of air-dry herbage ranges from 1,200 to 3,000 pounds per acre. About two-thirds of this production is from plants that furnish forage for livestock and wildlife.

SHALLOW REDLAND RANGE SITE

This site consists of moderately deep, gently sloping to steep, clayey soils on uplands.

These soils are well drained. Permeability is very slow and moderately slow. Available water capacity is high. The downward movement of water and plant roots is slow. The soils need a good plant cover to reduce evaporation and to control water erosion. This site produces mostly mid and short grasses.

The climax plant community is 20 percent side-oats grama, 10 percent blue grama, 10 percent feathery bluestem, 10 percent tobosagrass, 10 percent buffalograss, 5 percent vine-mesquite, 5 percent black grama, 5 percent sand bluestem and little bluestem, 10 percent vine ephedra, agarito, catclaw acacia, and daleas, 5 percent heath aster, prairie clover, and guaras, 5 percent other perennial grasses, and 5 percent other perennial forbs.

If the site deteriorates under continued overgrazing, groundsels, broom snakeweed, stillingia, red grama, hairy tridens, and other annuals dominate.

If the site is in excellent condition, the annual production of air-dry herbage ranges from 800 to 1,500 pounds per acre. About 80 percent of this production is suitable forage for livestock and wildlife.

VALLEY RANGE SITE

This site consists of nearly level, loamy soils on lowlands in the major draws.

Extra water is received from runoff. Although this site is flooded from time to time, it is underwater for only a short period. Damage to vegetation generally is

***Figure 17.*—Area of Sandy Loam range site. Wide variety of highly nutritious forage plants on Patricia fine sandy loam, 1 to 3 percent slopes.**

from sedimentation rather than from wetness. This site is well drained and moderately permeable. Available water capacity is high. If this site is in good and excellent condition, it is capable of producing an abundance of short and mid grasses.

The climax plant community generally is 20 percent side-oats grama, 10 percent vine-mesquite, 10 percent western wheatgrass, 10 percent blue grama, 5 percent buffalograss, 5 percent Texas wintergrass, 5 percent feathery bluestem, 5 percent tobosagrass, 5 percent meadow dropseed, 5 percent white tridens, 5 percent alkali sacaton, 5 percent hackberry and elm, 5 percent perennial forbs, and 5 percent other perennial grasses.

The grass on this site remains green longer than on other soils because it receives extra water from runoff. This site responds well to rest, especially if rested before all of the more desirable grasses are grazed out.

If this site is in excellent condition, the annual production of air-dry herbage ranges from 2,000 to 2,800 pounds per acre. The amount varies according to the amount of extra water received annually. About 90 percent of this production is suitable forage for cattle.

VERY SHALLOW RANGE SITE

This site consists of shallow to very shallow, gently sloping to steep soils on uplands.

These soils are well drained. Permeability is moderate. Available water capacity is low. The grasses are sparse (fig. 18).

The climax plant community is 15 percent little bluestem, 15 percent side-oats grama, 10 percent feathery bluestem, 5 percent blue grama, 5 percent plains bristle-grass, 5 percent black grama, 5 percent hairy grama, 5 percent buffalograss, 5 percent slim tridens, 10 percent perennial forbs, 10 percent perennial browse, and 10 percent other perennial grasses.

If the site deteriorates under continuous overgrazing, mesquite, pricklypear, cactus, broom snakeweed, and numerous annuals invade.

This site is generally in better condition than adjacent sites, and the better grasses are rarely grazed out. Generally there are enough of the better grasses on the site to justify the use of a management program to improve the vegetation.

If this site is in excellent condition, the annual production of air-dry herbage ranges from 400 to 1,700 pounds per acre. This yield varies according to the rainfall received annually. However, it does not fluctuate so widely as on other sites, because this site is effective in using limited amounts of moisture. About 60 percent of the production is from plants that furnish forage for livestock.

Wildlife [4]

In Borden County the principal kinds of wildlife are scaled quail, bobwhite quail, ducks, dove, cottontail rabbits jackrabbits turkey, antelope, and deer. Also present are raccoons, skunks, and other furbearers (fig. 19).

Predators commonly found in the area are coyotes and bobcats. Many species of nongame birds, reptiles, and small mammals are found in the county.

Quail and dove are the main game birds. The number of doves is not constant, because of their migratory habit. Although the quail population is more certain, it varies with rainfall and range condition. Playa lakes, ponds, and Lake J. B. Thomas attract a few ducks during migration. Big game hunting in Borden County is limited to antelope and deer. The antelope population is about 600. Most farm and ranch ponds are stocked with channel catfish, black bass, and sunfish. Lake J. B. Thomas offers good fishing.

Successful management of wildlife on any tract of land requires, among other things, that food, cover, and water be available in a suitable combination. Lack of any one of these necessities, an unfavorable balance

[4] By JAMES HENSON, biologist, Soil Conservation Service.

Figure 18.—**Area of Potter soils in Very Shallow range site. These soils have limited capacity to produce grass.**

Figure 19.—Antelope on an Olton clay loam.

between them, or inadequate distribution of them may severely limit or account for the absence of desired wildlife species. Information on soils provides a valuable tool in creating, improving, or maintaining suitable food, cover, and water for wildlife.

Most wildlife habitats are managed by planting suitable vegetation, by manipulating existing vegetation in order to bring about natural establishment, by increasing or improving desired plants, or by using combinations of these measures. The influence a soil has on the growth of plants is known for many plants, and for others can be inferred from the known characteristics and behavior of the soil. In addition, water areas can be created, or natural ones improved, as wildlife habitat.

Soil interpretations for wildlife habitat serve a variety of purposes: they aid in selecting the more suitable sites for various kinds of management, they indicate the level of management intensity that is needed to achieve satisfactory results, and they show why it generally may not be feasible to manage a particular area for a given kind of wildlife. These interpretations also help in the broad-scale planning of wildlife management areas, parks, and nature areas, or in the acquisition of wildlife lands.

Soil properties that affect the growth of wildlife habitat are thickness of soil useful to crops, surface texture, available water capacity to a depth of 40 inches, wetness, surface stoniness or rockiness, hazards of flooding, and slope.

Table 3 rates the soils of Borden County for the creation, improvement, or maintenance of six elements of wildlife habitat. These ratings are based on limitations imposed by the characteristics or behavior of the soils. Four levels of suitability are recognized. Numerical ratings of 1 to 4 indicate the degree of soil suitability for a given habitat element.

A rating of 1 means well suited and indicates that habitats generally are easily created, improved, or maintained; that the soil has few or no limitations that affect management; and that satisfactory results can be expected.

A rating of 2 means suited and indicates that habitats can be created, improved, or maintained in most places; that the soil has moderate limitations that affect management; and that a moderate intensity of management and fairly frequent attention may be required for satisfactory results.

A rating of 3 means poorly suited and indicates that habitats can be created, improved, or maintained

TABLE 3.—*Suitability of soils for elements of wildlife habitat and kinds of wildlife*

[A rating of 1 indicates the soil is well suited; 2, suited; 3, poorly suited; and 4, unsuited]

Soil series and map symbols	Elements of wildlife habitat						Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood trees and shrubs	Wetland food and cover plants	Shallow water developments	Open-land	Brushland	Wetland
Acuff: AcA, AcB	1	1	1	4	4	4	1	3	4
Amarillo: AmA, AmB, AmC	1	1	1	4	4	4	1	3	4
Arch: ArB	2	2	2	4	3	3	2	3	3
Badland: Ba	4	4	4	4	4	4	3	3	4
Berda: BeB, BeC	1	1	1	4	4	4	1	3	4
Bippus: BpA, BpB	1	1	1	4	4	4	1	3	4
Brownfield: Br	2	2	3	3	4	4	2	2	4
Colorado: Co	3	2	2	4	4	4	2	3	4
For Spur part, see Spur series.									
Estacado: EsA, FsB	1	1	1	4	4	4	1	3	4
Kimbrough: Km	4	4	3	4	4	4	3	3	4
Latom: La	3	3	2	4	4	4	3	3	4
Lipan: Ln	3	3	2	4	3	3	3	3	3
Lofton: Lo	2	2	1	4	2	2	2	3	2
Mangum: Ma, Mc	3	2	2	4	4	4	2	3	4
Mobeetie: MoB	1	1	1	4	4	4	1	3	4
Olton: OcA, OcB	1	1	1	4	4	4	1	3	4
Patricia: PaB, PfB	1	1	1	4	4	4	1	3	4
Polar: Po	3	2	2	4	4	4	2	3	4
Posey: PsB, PsC	1	1	1	4	4	4	1	3	4
Potter: Pt	4	4	3	4	4	4	3	3	4
Rotan:	1	1	1	4	4	4	1	3	4
Mapped only in a complex with Rowena soils.									
Rough broken land: Ro	4	4	4	4	4	4	4	4	4
Rowena: RrA, RrB	1	1	1	4	4	4	1	3	4
For Rotan part, see Rotan series.									
Sharvana: SnB	3	3	2	4	4	4	3	3	4
Slaughter:	3	3	2	4	4	4	3	3	4
Mapped only in a complex with Stegall soils.									
Spade: SlC	2	1	1	4	4	4	1	3	4
For Latom part, see Latom series.									
Spur: Sp	2	1	1	4	4	4	1	3	4
Stamford: StA, StB	2	2	2	4	4	4	2	3	4
Stegall: SuA	2	1	1	4	4	4	1	3	4
For Slaughter part, see Slaughter series.									
Veal: VaB, VaC, VoD	2	1	1	4	4	4	1	3	4
For Potter part of VbD, see Potter series.									
Vernon: VcB, VcE, Ve, VpF	2	2	2	4	4	4	2	3	4
For Badland part of Ve, see Badland; for Potter part of VpF, see Potter series.									
Weymouth: WvB	2	1	1	4	4	4	1	3	4
For Vernon part, see Vernon series.									

in most places; that the soil has rather severe limitations; that habitat management is difficult and expensive and requires intensive effort; and that results are not always satisfactory. For short-term usage, soils rated as poorly suited may provide easy establishment of habitat and give temporary value.

A rating of 4 means unsuited and indicates that the soil limitation is so extreme that it is impractical, if not impossible, to manage the designated habitat element. Unsatisfactory results are probable.

The six habitat elements rated in table 3 are briefly described in the following paragraphs.

Grain and seed crops are grains or seed-producing annuals planted to produce food for wildlife. Examples are corn, sorghum, millet, soybeans, wheat, oats, and sunflower.

Grasses and legumes are domestic perennial grasses and legumes that are established by planting and that furnish food and cover for wildlife. Examples are sudangrass, sorghum almum, blue panicum, and panic-

grasses. Legumes include species such as clovers, annual lespedeza, and bush lespedeza.

Wild herbaceous plants are perennial grasses, forbs, and weeds that provide food and cover for wildlife. Examples are woollybucket, bumelia, western ragweed, erect dayflower, common sunflower, rescuegrass, switchgrass, plains bristlegrass, and broomweed.

Hardwood trees and shrubs are nonconiferous trees, shrubs, and woody vines that produce fruits, nuts, buds, catkins, or foliage browse used extensively as food by wildlife. These plants commonly become established through natural processes, but they may be planted. Examples are oak, mesquite, four-wing saltbush, redberry juniper, whitebrush, granjeno, catclaw, plum, and greenbrier.

Wetland food and cover plants are annual and perennial wild herbaceous plants in moist to wet sites, exclusive of submerged or floating aquatics, that produce food or cover that is extensively and dominantly used by wetland forms of wildlife. Examples are smartweed, wild millet, bulrush, spikesedge, rushes, sedges, burreeds, and cattails.

Shallow water developments are low dikes and water control structures established to create habitat principally for waterfowl. They may be designed so that they can be drained, planted, and flooded, or they may be used as permanent impoundments to grow submerged aquatics.

The three general kinds of wildlife rated in Table 3 are described in the following paragraphs.

Open-land wildlife consists of birds and mammals that normally frequent cropland, pastures, and areas overgrown with grasses, herbs, and shrubby growth. Examples of this kind of wildlife are quail, antelope, cottontail rabbits, jackrabbits, meadowlarks, and lark sparrows.

Brushland wildlife consists of birds and mammals that normally frequent areas of hardwood trees and shrubs. Examples of brushland wildlife are deer, turkey, squirrels, raccoons, and various species of nongame birds.

Wetland wildlife consists of birds and mammals that normally frequent such areas as ponds, streams, ditches, marshes, and swamps. Examples of this kind of wildlife are ducks and geese.

The soils are rated in Table 3 without regard to their relationship to other soils. The size, shape, or location of the areas does not affect the rating. Interpretations of some influences on habitats, such as elevation and aspect, must be made onsite.

Recreation

Knowledge of soils is helpful in planning, developing, and maintaining areas to be used for recreation.

Table 4 rates the soils of Borden County for recreational uses. Ratings used are slight, moderate, and severe. Recreational land uses are described in the following paragraphs.

Camp areas are areas used intensively for tents, small camp trailers, and the accompanying activities of outdoor living. It is assumed that little site preparation needs to be done other than shaping and leveling for tent and parking areas. The soils should be suitable for heavy foot traffic and for limited vehicular traffic. The suitability of the soils for growing and maintaining vegetation is not a part of this evaluation, but it should be considered in the final evaluation of a site.

Picnic areas are intensively used park-type areas. It is assumed that most vehicular traffic will be confined to access roads. The suitability of the soils for growing vegetation is not a part of this evaluation, but it should be considered in the final evaluation of a site.

Playgrounds are areas used for baseball, football, badminton, and similar organized games. These areas are subject to intensive foot traffic. A nearly level surface, good drainage, and a soil texture and consistency that gives a firm surface are generally required. Desirable soils are free of rock outcrops and coarse fragments. The suitability of the soils for growing vegetation is not a part of this evaluation, but it is important in the final evaluation of a site.

Paths and trails consist of local and cross-country footpaths, trails, and bridle paths. It is assumed that these areas will be used as they occur in nature and that little or no soil will be moved (excavated or filled). Soil features that affect trafficability, creation of dust, and design and maintenance of trafficways are given special emphasis in this evaluation.

Engineering Uses of the Soils [5]

The section provides information of special interest to engineers, contractors, farmers, and others who use soils as structural materials or as foundations for structures. Information is given in this section about those properties of the soils that affect construction and maintenance of roads and airports, pipelines, building foundations, water storage facilities, erosion control structures, drainage systems and sewage disposal systems. Among the soil properties most important in engineering are permeability, compressibility, shear strength, density, shrink-swell potential, waterholding capacity, grain-size distribution, plasticity, and reaction.

Information concerning these and related soil properties are furnished in tables 5, 6, and 7. The estimates and interpretations of soil properties in these tables can be used in—

1. Planning agricultural drainage systems, farm ponds, irrigation systems, diversion terraces, and other structures for controlling water and conserving soil.
2. Selecting potential locations for highways, airports, pipelines, and underground cables.
3. Locating probable sources of sand, gravel, or rock suitable for use as construction material.
4. Selecting potential industrial, commercial, residential, and recreational areas.

[5] By BEADE O. NORTHCUT, civil engineer, Soil Conservation Service.

TABLE 4.—*Degree and kind of limitation of the soils for recreation*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
Acuff: AcA, AcB	Slight	Slight	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 3 percent.	Slight.
Amarillo: AmA, AmB, AmC	Slight	Slight	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 5 percent.	Slight.
Arch: ArB	Slight	Slight	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 3 percent.	Slight.
Badland: Ba. Interpretations not made; material too variable.				
Berda: BeB, BeC	Slight	Slight	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 5 percent.	Slight.
Bippus: BpA, BpB	Moderate: clay loam texture.	Moderate: clay loam textures.	Moderate: clay loam texture.	Moderate: clay loam texture.
Brownfield: Br	Severe: fine sand texture.	Severe: fine sand texture.	Severe: fine sand texture.	Severe: fine sand texture.
*Colorado: Co For Spur part, see Spur series.	Severe: flood hazard	Moderate: flood hazard	Severe: flood hazard	Moderate: flood hazard.
Estacado: EsA, EsB	Moderate: clay loam texture.	Moderate: clay loam texture.	Moderate: clay loam texture.	Moderate: clay loam texture.
Kimbrough: Km	Slight	Slight	Severe: indurated caliche at a depth of 7 to 20 inches.	Slight.
Latom: La	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Severe: bedrock at a depth of 4 to 10 inches.	Slight where slopes are 0 to 15 percent. Moderate where slopes are 15 to 20 percent.
Lipan: Ln	Severe: clay texture; very slow permeability.	Severe: clay texture	Severe: clay texture; very slow permeability.	Severe: clay texture.
Lofton: Lo	Severe: very slow permeability.	Moderate: clay loam texture.	Severe: very slow permeability.	Moderate: clay loam texture.
Mangum: Ma, Mc	Severe: clay texture; very slow permeability.	Severe: clay texture	Severe: clay texture; very slow permeability.	Severe: clay texture.
Mobeetie: MoB	Slight	Slight	Slight	Slight.
Olton: OcA, OcB	Moderate: clay loam texture; moderately slow permeability.	Moderate: clay loam texture.	Moderate: clay loam texture; moderately slow permeability.	Moderate: clay loam texture.
Patricia: PaB	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture.
PfB	Slight	Slight	Slight	Slight.

TABLE 4.—*Degree and kind of limitation of the soils for recreation*—Continued

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
Polar: Po	Moderate where slopes are 8 to 15 percent and content of coarse fragments is 30 to 50 percent. Severe where slopes are 15 to 30 percent or content of coarse fragments is 50 to 60 percent.	Moderate where slopes are 8 to 15 percent and content of coarse fragments is 30 to 50 percent. Severe where slopes are 15 to 30 percent or content of coarse fragments is 50 to 60 percent.	Severe: 35 to 60 percent coarse fragments.	Moderate where slopes are 15 to 25 percent and content of coarse fragments is 30 to 50 percent. Severe where slopes are 15 to 30 percent or content of coarse fragments 50 to 60 percent.
Posey: PsB, PsC	Slight	Slight	Slight where slopes are 1 to 2 percent; moderate where 2 to 5 percent slopes.	Slight.
Potter: Pt	Slight where slopes are 2 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 30 percent.	Slight where slopes are 2 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 30 percent.	Severe: indurated caliche at a depth of 4 to 10 inches.	Slight where slopes are 2 to 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are 25 to 30 percent.
Rotan: Mapped only in complexes with Rowena soils.	Moderate: clay loam texture; moderately slow permeability.	Moderate: clay loam texture.	Moderate: clay loam texture; moderately slow permeability.	Moderate: clay loam texture.
Rough broken land: Ro. Interpretations not made; material too variable.				
*Rowena: RrA, RrB For Rotan part, see Rotan series.	Moderate: clay loam texture; moderately slow permeability.	Moderate: clay loam texture.	Moderate: clay loam texture; moderately slow permeability.	Moderate: clay loam texture.
Sharvana: ShB	Slight	Slight	Severe: indurated caliche at a depth of 10 to 20 inches.	Slight
Slaughter: Mapped only in a complex with Stegall soils.	Moderate: clay loam texture; moderately slow permeability.	Moderate: clay loam texture.	Severe: indurated caliche at a depth of 11 to 20 inches.	Moderate: clay loam texture.
*Spade: SlC For Latom part, see Latom series.	Slight	Slight	Moderate where slopes are 2 to 5 percent.	Slight.
Spur: Sp	Severe: flood hazard	Moderate: flood hazard; clay loam texture.	Severe: flood hazard	Moderate: flood hazard; clay loam texture.
Stamford: StA, StB	Severe: clay texture; very slow permeability.	Severe: clay texture	Severe: clay texture; very slow permeability.	Severe: clay texture.
*Stegall: SuA For Slaughter part, see Slaughter series.	Moderate: clay loam texture; moderately slow permeability.	Moderate: clay loam texture.	Moderate: indurated caliche at a depth of 20 to 35 inches; moderately slow permeability.	Moderate: clay loam texture.
*Veal: VaB, VaC, VbD For Potter part of VbD, see Potter series.	Slight	Slight	Slight where slopes are 1 to 2 percent. Moderate where slopes are 2 to 6 percent. Severe where slopes are 6 to 8 percent.	Slight.

TABLE 4.—*Degree and kind of limitation of the soils for recreation*—Continued

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
*Vernon: VcB, VcE, Ve, VpF. For Badland part of Ve, see Badland; for Potter part of VpF, see Potter series.	Severe: clay texture; very slow permeability.	Severe: clay texture.	Severe: clay texture; very slow permeability.	Severe: clay texture.
*Weymouth: WvB. For Vernon part, see Vernon series.	Moderate: clay loam texture.	Moderate: clay loam texture.	Moderate where slope is 2 to 3 percent; clay loam texture.	Moderate: clay loam texture.

The engineering interpretations reported here do not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and where the excavations are deeper than the depths of layers reported. However, even in these situations the soil map is useful in planning more detailed field investigations and for indicating the kinds of problems that may be expected. Inspection of the sites is needed because many mapped areas of a given soil may contain small areas of other kinds of material that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some terms used by soil scientists may be unfamiliar to engineers, and some words have different meanings in soil science than they have in engineering. Among the terms that have special meaning in soil science are gravel, sand, silt, clay, surface layer, subsoil, and horizon. These and other terms are defined in the Glossary at the back of the report.

Engineering classification systems

The two systems most commonly used in classifying samples of soil horizons for engineering are the AASHO system (*1*), adopted by the American Association of State Highway Officials, and the Unified soil classification system (*8*), used by Soil Conservation Service engineers, the Department of Defense, and others.

The AASHO system is used to classify soils according to those properties that affect use in highway construction. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. Group A–1 consists of gravelly soils of high shear strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet. Therefore, the best soils for subgrade are classified as A–1, the next best are classified as A–2, and so on to class A–7, which are the poorest soils for subgrade. Where laboratory data are available to justify further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7; A–7–5, A–7–6. If soil material is near a classification boundary, it is given a symbol showing both classes; for example, A–2 or A–4. Within each group, the relative engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 for the poorest.

In the Unified soil classification system, soils are classified according to particle-size distribution, plasticity index, liquid limit, and organic-matter content. Soils are grouped in fifteen classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example CH-MH.

Estimated engineering properties

Table 5 provides estimates of soil properties important to engineering. The estimates are based on field classification and descriptions, physical and chemical tests of selected representative samples, test data from comparable soils in adjacent areas, and detailed experience in working with the individual kinds of soil in the survey area.

Hydrologic soil groups are used in watershed planning to estimate runoff from rainfall. Soil properties are considered that influence the minimum rate of infiltration for a bare soil after prolonged wetting. These properties are depth of the seasonally high water table, depth to a very slowly permeable layer, intake rate, and permeability. The influence of ground cover is not treated in hydrologic soil groups. The soils are classified into groups that have similar rates of infiltration of water even when wet and similar rates of water transmission within the soil. There are four such hydrologic groups.

Group A consists of soils that have a low runoff potential. These soils have a high infiltration rate when thoroughly wetted and are mainly deep, well-drained to excessively drained sand or gravel. These soils have a high rate of water transmission.

Group B consists of soils that have a moderately low runoff potential. These soils have a moderate infiltration rate when thoroughly wetted and are mainly moderately deep to deep, moderately well drained to well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C consists of soils that have a moderately high runoff potential. These soils have a slow infil-

tration rate when thoroughly wetted and are mainly soils that have a layer that impedes downward movement of water; soils that have moderately fine to fine texture; or soils that have a moderately high water table. Some of these soils are somewhat poorly drained.

Group D consists of soils that have a high runoff potential. These soils have a very slow infiltration rate when thoroughly wetted and are mainly clays that have a high swelling potential; soils that have a permanent high water table; soils that have a claypan or clay layer at or near the surface; and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to bedrock is the depth that solid rock underlies the soil.

Salinity does not present a serious problem in Borden County and is not included in Table 5.

Depth to the water table is many feet below the surface and is not included in the table.

USDA texture is determined by the relative proportions of sand, silt, and clay in soil material that is less than 2.0 millimeters in diameter.

Permeability, as used in table 5, relates only to the movement of water downward through undisturbed and uncompacted soils. It does not include lateral seepage. The estimates are based on the structure and porosity of the soils. The presence of plowpans, surface crusts, and other properties resulting from use of the soils are not considered. It should not be confused with the coefficient of permeability, "k," used by engineers.

Available water capacity is the amount of water a soil can hold and make available to plants. It is the numerical difference between the percentage of water at field capacity and the percentage of water at which plants wilt. The rate is expressed as inches of water per inch of soil depth.

Reaction is the degree of acidity or alkalinity of a soil expressed as a pH value. The pH value and relative terms used to describe soil reaction are explained in the glossary.

Shrink-swell potential indicates the change in volume of the soil to be expected with changes in moisture content. Shrinking and swelling of soil causes much damage to foundations, roads, and other structures. A *high* shrink-swell potential indicates hazards to the maintenance of structures constructed in, on, or of such materials.

Engineering interpretations

Table 6 contains selected information useful to engineers and others who plan to use soil material in construction of highways, farm facilities, buildings, and sewage disposal systems. Detrimental or undesirable features are emphasized, but very important desirable features may be listed also. Ratings and other interpretations in this table are based on estimates of engineering properties in table 5; on available test data, including those in table 7; and on field experience. While the information strictly applies to soil depths indicated in table 5, it is reasonably reliable to depth of about 6 feet for most soils.

Topsoil is a term used to designate a fertile soil or soil material. Topsoil is ordinarily rich in organic matter and is used as a topdressing for lawns, gardens, roadbanks and other areas. The ratings indicate suitability for such use.

Road subgrade is material used to build embankments. The ratings indicate performance of soil material moved from borrow areas for these purposes.

Highway location is influenced by features of the undisturbed soil that affect construction and maintenance of highways. The soil features, favorable as well as unfavorable, are the principal ones that affect the geographic location of highways.

Dwellings are influenced mainly by features of the undisturbed soil that affect the capability to support dwellings that have normal foundation loads.

Septic tank filter fields are influenced mainly by permeability, location of the water table, and susceptibility to flooding. The degree of limitation and principal reasons for assigning moderate or severe limitations are given.

Sewage lagoons are influenced mainly by soil features such as permeability, location of the water table, and slope. The degree of limitation and principal reasons for assigning moderate or severe limitations are given.

Farm pond reservoir areas are affected mainly by loss of water by seepage. The soil features considered are those that influence such seepage.

Farm pond embankments serve as dams. The soil features evaluated, both the subsoil and substream, are those features that are important to the use of soils for constructing embankments.

Irrigation. The factors considered are those features and qualities of soils that affect their suitability for irrigation.

Terraces and diversions. Factors considered for diversions and terraces are those features and qualities of soils that affect their stability or hinder layout and construction.

Grassed waterways. The factors considered for waterways are those features and qualities of soils that affect the establishment, growth, and maintenance of plants. Factors that hinder layout and construction are also considered.

Corrosivity, as used in the table, indicates the potential danger to uncoated metal through chemical action that dissolves or weakens the structural material. Structural materials may corrode when buried in soil; certain materials may corrode in some kinds of soil more rapidly than in others. Extensive installations that intersect soil boundaries or soil horizons are more likely to be damaged by corrosion than installations that are entirely in one kind of soil or soil horizon. All the soils in Borden County are rated low for corrosivity of concrete, so this rating is not included in Table 6.

Sand and gravel ratings are not included in Table 6, because only the Polar soils in Borden County are considered to be a suitable source of these materials.

Dikes and levees and winter grading are not included in table 6, because the soils on which these practices are applicable do not present any problems in Borden County.

TABLE 5.—*Estimated soil properties*

[An asterisk in first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such to other series that appear in the first column of this table. The

Soil series and map symbols	Hydrologic group	Depth to bedrock	Depth from surface	Classification		
				USDA texture	Unified	AASHO
		In	*In*			
Acuff: AcA, AcB	B	>120	0–7	Loam	CL	A–6 or A–4
			7–26	Sandy clay loam	CL	A–6
			26–80	Sandy clay loam	CL	A–6
Amarillo: AmA, AmB, AmC	B	>120	0–7	Fine sandy loam	SM	A–4
			7–17	Sandy clay loam	SC or CL	A–6
			17–84	Sandy clay loam	SC or CL	A–6
Arch: ArB	B	>120	0–8	Loam	CL	A–6
			8–60	Clay loam	CL	A–6, A–7–6
Badland: Bd. Too variable to be rated.						
Berda: BeB, BeC	B	>120	0–26	Loam	CL, SC	A–6
			26–84	Clay loam	CL	A–6
Bippus: BpA, BpB	B	>120	0–74	Clay loam	CL	A–6
Brownfield: Br	A	>120	0–26	Fine sandy loam	SM, SP–SM	A–2
			26–62	Sandy clay loam	SC, SM–SC	A–2, A–6
			62–84	Loamy fine sand	SM	A–2
*Colorado: Co. For Spur part, see Spur series.	B	>120	0–50	Clay loam	CL	A–6
Estacado: EsA, EsB	B	>120	0–80	Clay loam	CL	A–6
Kimbrough: Km	C	7–20	0–8	Loam	CL	A–6
			8–24	Indurated caliche.		
			24–50	Weakly cemented caliche.		
Latom: La	D	4–20	0–9	Fine sandy loam	SM	A–2
			9–20	Strongly cemented sandstone.		
Lipan: Ln	D	>120	0–75	Clay	CH	A–7
Lofton: Lo	D	>120	0–7	Clay loam	CL	A–6
			7–35	Clay	CL	A–7
			35–60	Clay	CL	A–7
			60–92	Clay loam	CL	A–6
Mangum: Ma, Mc	D	>120	0–48	Clay	CH	A–7
Mobeetie: MoB	B	>120	0–60	Fine sandy loam	SM or CL–ML	A–4
Olton: OcA, OcB	C	>120	0–7	Clay loam	CL	A–6
			7–16	Clay loam	CL	A–6 or A–7
			16–29	Clay	CL	A–6 or A–7
			29–80	Clay loam	CL	A–6
Patricia: PaB, PfB	B	>120	0–8	Fine sandy loam	SM	A–4
			8–44	Sandy clay loam	SC	A–6
			44–80	Sandy clay loam	SC	A–6, A–2
Polar: Po	B	>120	0–9	Gravelly sandy clay loam.	GM	A–2
			9–60	Gravelly and very gravelly sandy loam.	GM	A–2
Posey: PsB, PsC	B	>120	0–9	Loam	ML	A–4
			9–80	Clay loam	CL	A–6

significant to engineering

mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring symbol > means greater than; the symbol < means less than]

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)				
				In per hr	*In per in of soil*	*pH*	
100	100	95–100	55–70	0.63–2.0	0.14–0.17	6.6 7.3	Low.
100	100	95–100	65–75	0.63–2.0	0.15–0.18	6.6–8.4	Low.
100	100	90–100	60–75	0.63–2.0	0.12–0.15	6.6–8.4	Low.
100	100	95–100	36–45	2.00–6.3	0.11–0.15	7.4–7.8	Low.
100	100	95–100	36–55	0.63–2.0	0.15–0.17	7.4–8.4	Low.
100	100	95–100	36 55	0.63 2.0	0.15 0.17	7.4 8.4	Low.
100	100	90–100	70–90	0.63–2.0	0.14–0.17	7.9–8.4	Low.
97–100	97–100	90–100	70–90	0.63 2.0	0.14 0.17	7.9 8.4	
95–100	95–100	80–95	45–60	0.63–2.0	0.14–0.17	7.9–8.4	Low.
95–100	95 100	80 95	51–60	0.63 2.0	0.14 0.17	7.9 8.4	Low.
100	95–100	80–100	55–70	0.63–2.0	0.16–0.20	7.9–8.4	Low.
100	100	95–100	5–20	6.3–20.0	0.04–0.08	6.1–7.3	Low.
100	100	90–100	25–45	0.63–2.0	0.12–0.16	6.1–7.3	Low.
100	100	95 100	15–20	2.00–6.3	0.05–0.08	6.6–7.3	Low.
100	100	85–95	70–80	0.63–2.0	0.16–0.18	7.9–8.4	Low.
100	98–100	95–100	55–70	0.63–2.0	0.14–0.18	7.9–8.4	Low.
95–100	95–100	85–95	60–75	0.63–2.0	0.13–0.15	7.9–8.4	Low.
90–100	85 95	80–90	25–35	0.63–2.0	0.10–0.14	7.9–8.4	Low.
100	100	95–100	85–95	<0.06	0.15–0.18	7.4–8.4	High.
100	100	98 100	70–80	0.20–0.63	0.16–0.20	7.4–7.8	Moderate.
100	100	95–100	80–90	0.06	0.16–0.20	7.4–8.4	High.
100	100	95–100	80–90	0.06	0.16–0.20	7.9–8.4	High.
100	100	98 100	70–80	0.20–0.63	0.12–0.16	7.9–8.4	Moderate.
100	100	90–100	90–95	<0.06	0.15–0.18	7.4–8.4	High.
95–98	90–95	90–95	45–60	2.00–6.3	0.10–0.14	7.9–8.4	Low.
100	95–100	85–90	55–75	0.63–2.0	0.15–0.20	7.4–7.8	Low.
100	90–100	90–100	70–80	0.20–0.63	0.15–0.20	7.9–8.4	Moderate.
100	90–100	90–100	75–85	0.20 0.63	0.15–0.20	7.9–8.4	Moderate.
90–100	90–100	90–100	65–75	0.20–0.63	0.10–0.15	7.9–8.4	Moderate.
100	100	95 100	36–45	2.00–6.3	0.11–0.15	6.6–7.3	Low.
100	100	95–100	36–45	0.63–2.0	0.15–0.16	6.6–7.8	Low.
100	100	95–100	20–45	0.63–2.0	0.12–0.16	7.9–8.4	Low.
45–70	40–65	30–40	15–25	2.0–6.3	0.04–0.09	7.9–8.4	Low.
40–65	30–65	25–35	13–20	2.0–6.3	0.03–0.07	7.9–8.4	Low.
98–100	95–100	85–90	60 70	0.63 2.0	0.13 0.17	7.9 8.4	Low.
90–100	90–98	85–90	51–75	0.63–2.0	0.12–0.16	7.9–8.4	Low.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Hydrologic group	Depth to bedrock	Depth from surface	Classification		
				USDA texture	Unified	AASHO
		In	*In*			
Potter: Pt	C	4 10	0–6	Loam	ML, CL	A–6, A–4
			6–11	Slightly platy caliche.		
			11–40	Weakly cemented and powdery caliche.		
Rotan Mapped only in complexes with Rowena soils.	C	>120	0–8	Clay loam	CL	A–6
			8–18	Silty clay loam	CL	A–6
			18 42	Clay	CL	A–7
			42–80	Silty clay loam	CL	A–6 or A–7
Rough broken land: Ro. Too variable to be rated.						
*Rowena: RrA, RrB For Rotan part, see Rotan series.	C	>120	0–7	Clay loam	CL	A–6 or A–7
			7–36	Clay	CH or CL	A–7
			36–80	Clay loam	CL	A–6 or A–7
Sharvana: ShB	C	10–20	0–7	Fine sandy loam	SM–SC	A 4
			7–18	Sandy clay loam	SC or CL	A–6
			18–42	Indurated platy caliche and loamy earth.		
Slaughter Mapped only in a complex with Stegall soils.	C	11–20	0–6	Clay loam	CL	A 6
			6–18	Clay loam	CL	A–6 or A–7
			18–26	Indurated caliche.		
*Spade: SlC For Latom part, see Latom series.	B	20–40	0–26	Fine sandy loam	SM	A–4
			26–30	Cemented sandstone.		
Spur: Sp	B	>120	0–54	Clay loam	CL	A–6
Stamford: StA, StB	D	>120	0 36	Clay	CH	A–7
*Stegall: SuA For Slaughter part, see Slaughter series.	C	20–35	0–7	Clay loam	CL	A–6
			7–15	Clay loam	CL	A–6 or A–7
			15–26	Clay loam	CL	A–6 or A–7
			26–30	Indurated platy caliche.		
*Veal: VaB, VaC, VbD For Potter part of VbD, see Potter series.	B	>120	0 7	Fine sandy loam	SM–SC	A–4
			7–66	Sandy clay loam	SC or CL	A–6
			66–80	Loamy fine sand	SM or ML	A 4
*Vernon: VcB, VcE, Ve, VpF For Badland part of Ve, see Badland; for Potter part of VpF, see Potter series.	D	24–48	0–60	Clay	CL	A–7
*Weymouth: WvB For Vernon part, see Vernon series.	B	20–40	0–36	Clay loam	CL	A–6
			36–60	Clay and partially weathered redbed material.	CL	A–7

significant to engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)				
				In per hr	*In per in of soil*	*pH*	
80–95	70–90	60 85	60–70	0.63–2.0	0.12–0.16	7.9 8.4	Low.
100	100	95–99	70–80	0.63–2.0	0.15–0.19	7.4–7.8	Moderate.
100	100	95–99	70–85	0.20–0.63	0.15–0.19	7.4–8.4	Moderate.
100	100	95–99	80–95	0.20–0.63	0.14–0.18	7.9 8.4	High.
100	100	90–98	75 90	0.20–0.63	0.12–0.15	7.9–8.4	Moderate.
100	100	85–100	70–85	0.20–0.63	0.15–0.20	7.9–8.4	Moderate.
100	100	90–100	75–95	0.20–0.63	0.14–0.18	7.9–8.4	High.
95 100	90–100	85–100	70–85	0.20 0.63	0.11–0.15	7.9–8.4	Moderate.
100	100	85–99	45–50	2.00–6.3	0.11–0.15	6.6–7.3	Low.
100	100	80–100	45–72	0.63–2.0	0.14–0.17	6.6–7.3	Low.
100	100	90–95	70–75	0.63–2.0	0.16–0.20	6.6–7.3	Low.
100	100	80–90	70–90	0.20–0.63	0.15–0.19	7.4–7.8	Moderate.
100	98–100	75–85	40–50	2.00 6.3	0.10–0.14	7.9–8.4	Low.
100	100	95–100	75–95	0.63–2.0	0.10–0.14	7.9–8.4	Low.
100	100	95–100	80–95	<0.06	0.14–0.17	7.9–8.4	High.
100	100	85–95	65–75	0.63–2.0	0.15 0.19	6.6–7.3	Low.
100	100	90–100	70–90	0.20–0.63	0.16–0.20	7.4–7.8	Moderate.
100	100	90–100	70–90	0.20–0.63	0.16–0.20	7.9–8.4	Moderate.
95–100	95–100	85–95	40–50	2.00–6.3	0.10–0.14	7.9–8.4	Low.
95–100	90–100	80–95	40–65	0.63–2.0	0.12–0.16	7.9–8.4	Low.
90–100	90–100	70–95	36–60	2.00 6.3	0.08–0.12	7.9–8.4	Low.
100	90–100	95–100	80–95	<0.06	0.13–0.17	7.9–8.4	High.
100	95–100	90–100	70–85	0.63–2.0	0.16–0.18	7.9–8.4	Low.
100	100	95–100	80–90	0.20–0.63	0.08 0.14	7.9–8.4	Low.

TABLE 6.—*Interpretations of engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such to other series that appear in

Soil series and map symbols	Suitability as source of—		Degree of limitation and soil features affecting—			
	Topsoil	Road subgrade	Highway location	Dwellings	Septic tank filter fields	Sewage lagoons
Acuff: AcA, AcB	Fair: loam to a depth of 6 to 9 inches.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Slight	Moderate: moderate permeability.
Amarillo: AmA, AmB, AmC.	Fair: fine sandy loam to a depth of 7 to 9 inches.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Slight	Moderate: moderate permeability.
Arch: ArB	Fair: 6 to 20 inches of suitable material.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Slight	Moderate: moderate permeability.
Badland: Bd. Interpretations not made; material too variable.						
Berda: BeB, BeC	Fair: loam to a depth of 6 to 14 inches.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Slight	Moderate: moderate permeability; 2 to 5 percent slope.
Bippus: BpA, BpB	Fair: clay loam texture.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Slight	Moderate: moderate permeability.
Brownfield: Br	Poor: fine sandy surface layer.	Good to depth of 26 inches. Fair between depth of 26 and 62 inches: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Slight	Moderate: moderate permeability.
*Colorado: Co For Spur part, see Spur series.	Fair: clay loam texture.	Fair: fair traffic-supporting capacity.	Severe: flood hazard.	Severe: flood hazard.	Severe: flood hazard.	Moderate: moderate permeability.
Estacado: EsA, EsB	Fair: clay loam texture.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Slight	Moderate: moderate permeability.
Kimbrough: Km	Poor: fragments on 10 to 15 percent of surface area.	Poor: 7 to 20 inches of suitable material.	Severe: indurated caliche at a depth of 7 to 20 inches.	Severe: indurated caliche at a depth of 7 to 20 inches.	Severe: indurated caliche at a depth of 7 to 20 inches.	Severe: indurated caliche at a depth of 7 to 20 inches.
Latom: La	Poor: 4 to 20 inches of material over sandstone.	Poor: 4 to 20 inches of material over sandstone.	Severe: Bedrock at a depth of 4 to 20 inches.	Severe: bedrock at a depth of 4 to 20 inches.	Severe: bedrock at a depth of 4 to 20 inches.	Severe: bedrock at a depth of 4 to 20 inches.

properties of the soils

mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring the first column of this table|

Degree of limitation and soil features affecting—Continued		Soil features affecting—			Corrosivity to uncoated steel
Farm ponds		Irrigation	Terraces and diversions	Waterways	
Reservoir area	Embankments				
Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	All features favorable.	All features favorable.	All features favorable.	Moderate: sandy clay loam texture.
Moderate: moderate permeability.	Moderate: medium compressibility; fair stability.	All features favorable.	Erodible	Erodible	Moderate: sandy clay loam texture.
Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	High content of lime; high hazard of soil blowing.	High content of lime; high hazard of soil blowing.	High content of lime; high hazard of soil blowing.	High: conductivity.
Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Slope; erodible.	Erodible	Erodible	Moderate: clay loam texture; conductivity.
Moderate: moderate permeability.	Moderate: medium compressibility.	All features favorable.	Receives water from other areas.	All features favorable.	Moderate: clay loam texture.
Moderate: moderate permeability.	Moderate: poor resistance to piping and erosion.	Rapid intake rate; high hazard of soil blowing.	High hazard of soil blowing.	High hazard of soil blowing.	Moderate: sandy clay loam texture.
Moderate: moderate permeability.	Moderate: medium compressibility; fair resistance to piping and erosion.	Flood hazard	Flood hazard	Flood hazard	High: resistivity.
Moderate: moderate permeability.	Moderate: medium compressibility.	All features favorable.	All features favorable.	All features favorable.	Moderate: clay loam texture.
Severe: indurated caliche at a depth of 7 to 20 inches.	Severe: indurated caliche at a depth of 7 to 20 inches.	Indurated caliche at a depth of 7 to 20 inches.	Indurated caliche at a depth of 7 to 20 inches.	Indurated caliche at a depth of 7 to 20 inches.	Low.
Severe: bedrock at a depth of 4 to 20 inches.	Severe: bedrock at a depth of 4 to 20 inches.	Bedrock at a depth of 4 to 20 inches.	Bedrock at a depth of 4 to 20 inches.	Bedrock at a depth of 4 to 20 inches.	Low.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—		Degree of limitation and soil features affecting —			
	Topsoil	Road subgrade	Highway location	Dwellings	Septic tank filter fields	Sewage lagoons
Lipan: Ln	Poor: clay texture.	Poor: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential.	Severe: very slow permeability.	Slight
Lofton: Lo	Fair: clay loam surface layer.	Poor: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: very slow permeability.	Slight
Mangum: Ma, Mc	Poor: clay texture.	Poor: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential; poor traffic-supporting capacity; flood hazard.	Severe: high shrink-swell potential; flood hazard.	Severe: very slow permeability; flood hazard.	Slight
Mobeetie: MoB	Good	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Slight	Severe: moderately rapid permeability.
Olton: OcA, OcB	Fair: clay loam texture.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential.	Severe: moderately slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 3 percent.
Patricia:						
PaB	Poor: loamy fine sand surface layer.	Fair: fair traffic-supporting capacity.	Slight	Slight	Slight	Moderate: moderate permeability.
PfB	Fair: sandy loam to a depth of 8 to 20 inches.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Slight	Moderate: moderate permeability.
Polar: Po	Poor: 35 to 60 percent coarse fragments.	Good	Slight where slopes are 2 to 6 percent. Moderate where slopes are 6 to 15 percent. Severe where slopes are 15 to 30 percent.	Slight where slopes are 0 to 6 percent. Moderate where slopes are 6 to 15 percent. Severe where slopes are 15 to 30 percent.	Severe: inadequate filtration.	Severe: moderately rapid permeability.
Posey: PsB, PsC	Fair: loam or clay loam texture.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Slight	Moderate: moderate permeability.

properties of the soils—Continued

Degree of limitation and soil features affecting—Continued		Soil features affecting—			Corrosivity to uncoated steel
Farm ponds		Irrigation	Terraces and diversions	Waterways	
Reservoir area	Embankments				
Slight	Moderate: high compressibility.	Slow intake rate	Depressional areas	Depressional areas	High: clay texture.
Slight	Moderate: fair resistance to piping and erosion.	Slow intake rate	Depressional areas	Depressional areas	High: clay texture.
Slight	Moderate: high compressibility.	Slow intake rate; flood hazard.	Flood hazard	Flood hazard	High: clay texture.
Severe: moderately rapid permeability.	Moderate: poor resistance to piping and erosion.	Rapid intake rate	Moderate hazard of soil blowing and water erosion.	Moderate hazard of water erosion.	Low.
Moderate: moderate slow permeability.	Moderate: fair resistance to piping and erosion.	All features favorable.	All features favorable.	All features favorable.	Severe: clay texture.
Moderate: moderate permeability.	Moderate: fair stability; medium compressibility.	Rapid intake rate; high hazard of soil blowing.	High hazard of soil blowing.	High hazard of soil blowing.	Moderate: sandy clay loam texture.
Moderate: moderate permeability.	Moderate: medium compressibility; fair stability.	All features favorable.	All features favorable.	All features favorable.	Moderate: sandy clay loam texture.
Severe: moderately rapid permeability.	Moderate: poor resistance to piping and erosion.	Gravelly; slope	Gravelly; slope	Gravelly; slope	Low.
Moderate: moderate permeability.	Moderate: medium compressibility; fair resistance to piping and erosion.	High content of lime; high hazard of soil blowing.	High content of lime; high hazard of soil blowing.	High content of lime; high hazard of soil blowing.	Moderate: clay loam texture.

TABLE 6.--*Interpretations of engineering*

Soil series and map symbols	Suitability as source of —		Degree of limitation and soil features affecting—			
	Topsoil	Road subgrade	Highway location	Dwellings	Septic tank filter fields	Sewage lagoons
Potter: Pt	Poor: 4 to 10 inches of suitable material.	Fair: fair traffic-supporting capacity.	Moderate where slopes are 2 to 15 percent: fair traffic-supporting capacity. Severe where slopes are 15 to 30 percent.	Moderate where slopes are 2 to 15 percent. Severe where slopes are 15 to 30 percent.	Slight where slopes are 2 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 30 percent.	Severe: seepage; calcareous in substratum.
Rough broken land: Ro. Interpretations not made; material too variable.						
Rotan. Mapped only in complexes with Rowena soils.	Fair: surface layer of clay loam.	Poor: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: moderately slow permeability.	Slight
*Rowena: RrA, RrB. For Rotan part of RrA and RrB, see the Rotan series.	Fair: surface layer of clay loam.	Poor: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: moderately slow permeability.	Slight
Sharvana: ShB	Fair: fine sandy loam to a depth of 6 to 8 inches.	Poor: 10 to 20 inches of material.	Severe: indurated caliche at a depth of 10 to 20 inches.	Severe: indurated caliche at a depth of 10 to 20 inches.	Severe: indurated caliche at a depth of 10 to 20 inches.	Severe: indurated caliche at a depth of 10 to 20 inches.
Slaughter. Mapped only in a complex with Stegall soils.	Fair: 11 to 20 inches of clay loam over hard caliche.	Poor: 11 to 20 inches of material.	Severe: indurated caliche at a depth of 11 to 20 inches.	Severe: indurated caliche at a depth of 11 to 20 inches.	Severe: indurated caliche at a depth of 11 to 20 inches.	Severe: indurated caliche at a depth of 11 to 20 inches.
*Spade: SlC. For Latom part, see Latom series.	Good	Slight	Slight	Slight	Severe: bedrock at a depth of 20 to 40 inches.	Severe: moderately rapid permeability.
Spur: Sp	Fair: clay loam texture.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity; flood hazard.	Severe: flood hazard.	Severe: flood hazard.	Moderate: moderate permeability.
Stamford: StA, StB	Poor: clay texture.	Poor: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential.	Severe: very slow permeability.	Slight.
*Stegall: SuA. For Slaughter part, see Slaughter series.	Fair: clay loam texture.	Fair: 20 to 35 inches of suitable material.	Severe: indurated caliche at a depth of 20 to 35 inches.	Moderate: moderate shrink-swell potential.	Severe: moderately slow permeability; indurated caliche at a depth of 20 to 35 inches.	Severe: indurated caliche at a depth of 20 to 35 inches.

properties of the soils—Continued

Degree of limitation and soil features affecting—Continued		Soil features affecting—			Corrosivity to uncoated steel
Farm ponds		Irrigation	Terraces and diversions	Waterways	
Reservoir area	Embankments				
Severe: seepage; calcareous in substratum.	Severe: suitable material at a depth of 4 to 10 inches.	Suitable material at a depth of 4 to 10 inches.	Suitable material at a depth of 4 to 10 inches.	Suitable material at a depth of 4 to 10 inches.	Moderate: conductivity.
Moderate: moderately slow permeability.	Moderate: fair resistance to piping and erosion.	All features favorable.	All features favorable.	All features favorable.	High: clay texture.
Moderate: moderately slow permeability.	Moderate: high compressibility; fair resistance to piping and erosion.	All features favorable.	All features favorable.	All features favorable.	High: clay texture.
Severe: indurated caliche at a depth of 10 to 20 inches.	Severe: thickness of borrow material.	Severe: indurated caliche at a depth of 10 to 20 inches.	Severe: indurated caliche at a depth of 10 to 20 inches.	Severe: indurated caliche at a depth of 10 to 20 inches.	Moderate: sandy clay loam texture; conductivity.
Severe: indurated caliche at a depth of 11 to 20 inches.	Severe: 11 to 20 inches of borrow material.	Indurated caliche at a depth of 11 to 20 inches.	Indurated caliche at a depth of 11 to 20 inches.	Indurated caliche at a depth of 11 to 20 inches.	High: conductivity.
Severe: moderately rapid permeability.	Moderate where material is 24 to 40 inches thick. Severe where material is 20 to 24 inches thick.	Bedrock at a depth of 20 to 40 inches.	Bedrock at a depth of 20 to 40 inches.	All features favorable.	Low.
Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Flood hazard	Flood hazard	Flood hazard	Moderate: clay loam texture.
Slight	Moderate: high compressibility; fair stability.	Very slow intake rate.	All features favorable.	Erodible	High: clay texture.
Severe: 20 to 35 inches to indurated caliche.	Moderate: 20 to 35 inches of borrow material.	All features favorable.	All features favorable.	All features favorable.	High: conductivity.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—		Degree of limitation and soil features affecting—			
	Topsoil	Road subgrade	Highway location	Dwellings	Septic tank filter fields	Sewage lagoons
*Veal: VaB, VaC, VbD For the Potter part of VbD, see Potter series.	Fair: fine sandy loam to a depth of 6 to 8 inches.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Slight	Severe: seepage.
*Vernon: VcB, VcE, Ve, VpF. For Badland part of Ve, see Badland; for Potter part of VpF, see Potter series.	Poor: clay texture.	Poor: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential.	Severe: very slow permeability.	Slight where slopes are 1 to 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are 7 to 30 percent.
*Weymouth: WvB. For Vernon part, see Vernon series.	Fair: clay loam texture.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight.	Moderate: moderately slow permeability.	Moderate: moderately slow permeability.

Farm drainage poses no problem in Borden County and is not included in table 6.

Engineering test data

Table 7 contains the results of engineering tests performed by the Texas Highway Department on four soils in Borden County, Texas. This table shows the specific location where samples were taken, the depth to which sampling was done, and the results of tests performed to determine particle-size distribution and other properties significant in soil engineering.

Following are definitions of some of the properties described in table 7. The columns not discussed are self-explanatory or are defined elsewhere in this survey.

Shrinkage limit.—As moisture leaves a soil, the soil shrinks and decreases in volume in proportion to the loss in moisture until a condition of equilibrium is reached, where shrinkage stops although additional moisture is removed. The moisture content where shrinkage stops is called the shrinkage limit of the soil and is reported as the moisture content, by ovendry weight of soil.

Linear shrinkage.—Linear shrinkage is the decrease in one dimension, expressed as a percentage of the original dimension, of the soil mass when the moisture content is reduced from the stipulated percentage to the shrinkage limit.

Shrinkage ratio.—The shrinkage ratio is computed by dividing the amount of volume change resulting from the drying of a soil material by the amount of moisture lost through drying. The volume change used in computing shrinkage ratio is the change in volume that takes place in a soil when it dries from a given moisture content to a point where no further shrinkage takes place. The ratio is expressed numerically.

Liquid limit.—The liquid limit is the moisture content at which a soil passes from a plastic to a liquid state.

Plasticity index.—The plasticity index is defined as the numerical difference between the liquid limit and the plastic limit, which is the moisture content at which a soil changes from a semisolid to a plastic state.

Formation and Classification of the Soils

This section discusses the effects of the five factors of soil formation on the soils in Borden County. The system of soil classification is also explained, and the soil series in the county are placed in some categories of this system.

Factors of Soil Formation

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time that the

properties of the soils—Continued

Degree of limitation and soil features affecting—Continued		Soil features affecting—			Corrosivity to uncoated steel
Farm ponds		Irrigation	Terraces and diversions	Waterways	
Reservoir area	Embankments				
Severe: moderate permeability; calcareous in substratum.	Moderate: fair resistance to piping and erosion.	High lime; high hazard of soil blowing.	All features favorable.	High lime; high hazard of soil blowing.	High: conductivity.
Slight	Moderate: high compressibility; fair slope stability.	Slow intake rate	Erodible	Erodible	High clay texture; conductivity.
Moderate: moderately slow permeability.	Moderate: fair resistance to piping and erosion.	Slope; erodible	Erodible	Erodible	Moderate: clay loam texture.

forces of soil development have acted on the soil material.

Climate and vegetation are active factors of soil genesis. They influence the parent material that has accumulated through the weathering of rocks by slowly changing it into a natural body that has genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed for the changing of the parent material into a soil profile. Some horizons may take more time than others, but time is always required for horizon differentiation. Usually a long time is required for the development of distinct horizons.

The factors of soil genesis are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Parent material

Parent material is the unconsolidated mass in which a soil forms. The soils of Borden County formed in residual, outwash, and alluvial deposits.

The soils on the high plains in the northwestern and western parts of the county formed in the Quaternary or late Tertiary material commonly called Rocky Mountain outwash. The parent materials in these areas are largely alkaline, calcareous, unconsolidated, sandy, clayey, and silty deposits. This outwash has generally been reworked by the wind or affected by a high water table many times since it was first deposited.

The soils on the Rolling Plains in the northern, eastern, central, and southern parts of the county formed in two kinds of parent material. They consist of Triassic materials and a thick alluvial mantle of outwash material 3 to 30 feet thick. This outwash material is similar to that on the High Plains (*3*). An abrupt escarpment separates the soils of the High Plains from the soils of the Rolling Plains. Cretaceous formations crop out of this escarpment.

The residuum was from the underlying Dockum Formation of Triassic age. Stamford and Vernon soils formed over the clayey Triassic red-bed material, and Spade and Latom soils formed in material weathered from sandstone of Triassic age.

The outwash material is clay, loam, and coarse and fine sand. The loamy and clayey deposits give rise to soils in the Rotan, Rowena, and Olton series. The loamy and sandy deposits give rise to soils in the Patricia, Brownfield, Acuff, Amarillo, and Estacado series.

The soils in the county that formed in alluvium are in the Colorado, Mangum, and Spur series. These soils are very young and occur on the flood plains of the major creeks and rivers. Some of the lower flood plains are reworked continually, and new sediment is deposited annually.

Climate

Climate has had a definite effect on the development of the soils in Borden County. Some of the influencing factors of climate are precipitation, temperature, and wind.

TABLE 7.—*Engineering*

[Tests performed by the Texas Highway Department in accordance with standard

Soil name and location	Parent material	Texas report No.	Depth from surface	Shrinkage		
				Limit	Linear	Ratio
			Inches		*Percent*	
Arch loam:	Old alluvium or outwash sediment on plains.	69-360-R	0-8	22	8.4	1.65
4.4 miles E. and 0.1 mile S. of Borden-Lynn County line marker on Farm Road 1054. (Modal)		69-361-R	8-20	24	7.7	1.56
		69-362-R	20-40	19	7.8	1.74
		69-363-R	40-60	18	11.5	1.74
Rowena clay loam:	Loamy, calcareous outwash sediment.	69-349-R	0-7	16	12.7	1.87
In cultivated field, 0.16 mile N. of Farm Road 612 from point 0.12 mile W. of Borden-Scurry County line marker on Farm Road 612. (Modal)		69-350-R	7-18	17	15.5	2.01
		69-351-R	18-39	12	17.1	2.03
		69-352-R	39-59	12	15.2	2.03
		69-353-R	59-80	12	14.3	2.01
Sharvana fine sandy loam:	Loamy soil material over beds of indurated caliche.	69-358-R	0-7	16	2.8	1.83
0.15 mile W. of county road from point 1 mile E. and 0.55 mile N. of Berry Flat Church. (Modal)		69-359-R	7-18	16	11.2	1.85
Veal fine sandy loam:	Calcareous loamy sediment.	69-354-R	0-7	16	3.2	1.81
In pasture, 60 feet E. of Farm Road 1584 from point 7.45 miles E. and S. of Dawson-Borden County line marker on Farm Road 1584. (Modal)		69-355-R	7-18	16	6.6	1.83
		69-356-R	18-38	19	4.3	1.77
		69-357-R	38-66	17	5.3	1.83

[1] Mechanical analyses according to AASHO Designation T88-57(*1*). Results by this procedure frequently may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and material coarser than 2 milli-

Rainfall is limited, and the soils seldom get wet below a depth of more than 6 feet. Consequently, many soils have a horizon of calcium carbonate accumulation a few feet below the surface. Most of the young soils have lime throughout the horizons.

The temperature is high in summer and mild in winter. High temperatures and low rainfall have limited the accumulation of organic matter in the soils.

Living organisms

Plants, animals, insects, and bacteria are important in the formation of soils. Some of the changes caused by living organisms are gains in organic matter and nitrogen in the soil, gains or losses in plant nutrients, and changes in structure and porosity.

Vegetation, mainly grasses, has had a greater effect on the formation of soils in Borden County than have other living organisms.

Relief

Relief influences soil development through its effect on drainage and runoff. If other factors are equal, the degree of profile development depends mainly on the amount of moisture in the soil. Nearly level soils absorb more moisture and, ordinarily, have a more developed profile than steeper soils. Furthermore, many of the steeper soils erode almost as fast as they form.

Relief also affects the kind and amount of vegetation on the soil. Slopes that face north and east receive less direct sunlight than those that face south and west; consequently, they lose less moisture through evaporation. As a result, the vegetation is denser on slopes that face north and east.

Nearly level or slightly concave soils receive more moisture and produce more vegetation than sloping soils. As a result, these soils contain more organic matter, which imparts a darker color.

Time

Time is required for the formation of soils that have distinct horizons. The length of time that parent materials have been in place is reflected in the degree of development of the profile. The soils in Borden County range from young to old. The young soils have very little profile development, and the older soils have well-expressed horizons.

Soils on bottom lands are an example of young soils

test data

procedures of the American Association of State Highway Officials (AASHO) (*1*)]

Mechanical analysis [1]									Liquid limit	Plasticity index	Classification [2]	
Percentage passing sieve—						Percentage smaller than—					AASHO [3]	Unified
¾ in.	⅜ in.	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.005 mm	0.002 mm				
									Percent			
			100	99	74	62	25	17	40	16	A–6(10)	CL
			100	99	75	60	33	27	41	18	A 7 6(11)	CL
		100	99	98	74	63	38	32	35	17	A–6(11)	CL
	100	99	98	98	89	73	40	35	44	27	A–7–6(16)	CL
			100	99	83	73	42	28	43	22	A–7–6(13)	CL
			100	99	82	74	49	42	46	29	A–7–6(16)	CL
			100	99	84	75	51	46	49	33	A–7–6(17)	CL
	100	99	97	93	78	70	48	38	44	28	A–7–6(16)	CL
	100	99	99	96	75	65	41	35	40	25	A–6(14)	CL
			100	99	49	35	14	11	21	5	A–4(3)	SM–SC
				100	72	61	36	33	39	20	A–6(11)	CL
100	99	98	97	92	41	32	13	9	22	6	A–4(1)	SM–SC
100	98	97	96	90	45	38	21	17	28	14	A–6(3)	SC
	100	99	99	94	62	56	34	26	27	11	A–6(5)	CL
100	98	95	93	90	58	50	29	20	27	13	A–6(6)	CL

meters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes of soil.

[2] Unified and AASHO classification interpretations made by SCS personnel.

[3] Based on AASHO Designation M 145–49 (*1*).

lacking development; time is an important factor in the development of these soils. Nearly level to gently sloping soils that have been in place for long periods normally show the greatest profile development. Examples are Olton and Acuff soils. Time is also an important factor in the development of these soils.

Many shallow soils on steep slopes have been in the process of development for as long as the well-developed, nearly level soils. Geologic erosion has removed the effects of soil formation on the shallow soils, so these soils have not reached an equilibrium with their environment. Relief, rather than time, is the dominant soil-forming factor in this case. Examples are Weymouth, Potter, and Vernon soils.

Classification of the Soils

Soils are classified so that their significant characteristics can be more easily remembered. Classification enables us to assemble knowledge about the soils; to see their relationships to one another and to the whole environment; and to develop principles that help us in understanding their behavior and their response to manipulation. First through classification, and then through the use of soil maps, we can apply this knowledge of soils to specific fields and other tracts of land.

In classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and used in managing farms, fields, and rangeland; in developing rural areas; in engineering work; and many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*2*) and later revised (*5*). The system that is currently used was adopted for general use by the National Cooperative Soil Survey in 1965. This system is under continual study, and readers who are interested in the development of this system should read the latest literature available (*4, 7*).

Table 8 lists each soil series in Borden County according to its family, subgroup, and order in the current classification system according to information available in August 1970. Placement of some soil series in the current system may change as more precise information becomes available.

TABLE 8.—*Classification of soil series*

Soil series	Family	Subgroup	Order
Acuff	Fine-loamy, mixed, thermic	Aridic Paleustolls	Mollisols.
Amarillo	Fine-loamy, mixed, thermic	Aridic Paleustalfs	Alfisols.
Arch	Fine-loamy, mixed, thermic	Ustochreptic Calciorthids	Aridisols.
Berda	Fine-loamy, mixed, thermic	Aridic Ustochrepts	Inceptisols.
Bippus	Fine-loamy, mixed, thermic	Cumulic Haplustolls	Mollisols.
Brownfield	Loamy, mixed, thermic	Arenic Aridic Paleustalfs	Alfisols.
Colorado	Fine-loamy, mixed (calcareous), thermic	Typic Ustifluvents	Entisols.
Estacado	Fine-loamy, mixed, thermic	Calciorthidic Paleustolls	Mollisols.
Kimbrough	Loamy, mixed, thermic, shallow	Petrocalcic Calciustolls	Mollisols.
Latom	Loamy, mixed (calcareous), thermic	Lithic Ustic Torriorthents	Entisols.
Lipan	Fine, montmorillonitic, thermic	Entic Pellusterts	Vertisols.
Lofton	Fine, mixed, thermic	Vertic Argiustolls	Mollisols.
Mangum	Fine, mixed (calcareous), thermic	Vertic Ustifluvents	Entisols.
Mobeetie	Coarse-loamy, mixed, thermic	Aridic Ustochrepts	Inceptisols.
Olton	Fine, mixed, thermic	Aridic Paleustolls	Mollisols.
Patricia	Fine-loamy, mixed, thermic	Aridic Paleustalfs	Alfisols.
Polar	Loamy-skeletal, mixed, thermic	Ustollic Calciorthids	Aridisols.
Posey	Fine-loamy, carbonatic, thermic	Calciorthidic Paleustalfs	Alfisols.
Potter	Loamy, carbonatic, thermic, shallow	Ustollic Calciorthids	Aridisols.
Rotan	Fine, mixed, thermic	Pachic Paleustolls	Mollisols.
Rowena	Fine, mixed, thermic	Vertic Calciustolls	Mollisols.
Sharvana	Loamy, mixed, thermic, shallow	Petrocalcic Ustalfic Paleargids	Aridisols.
Slaughter	Clayey, mixed, thermic, shallow	Petrocalcic Paleustolls	Mollisols.
Spade	Coarse-loamy, mixed, thermic	Aridic Ustochrepts	Inceptisols.
Spur	Fine-loamy, mixed, thermic	Fluventic Haplustolls	Mollisols.
Stamford	Fine, montmorillonitic, thermic	Typic Chromusterts	Vertisols.
Stegall	Fine, mixed, thermic	Petrocalcic Paleustolls	Mollisols.
Veal	Fine-loamy, mixed, thermic	Aridic Ustochrepts	Inceptisols.
Vernon	Fine, mixed, thermic	Typic Ustochrepts	Inceptisols.
Weymouth	Fine-loamy, mixed, thermic	Typic Ustochrepts	Inceptisols.

General Nature of the County

This section is for those who desire general information about Borden County. It briefly discusses the settlement, farming, climate, and natural resources of the county.

History

Borden County was created on August 21, 1876, and was organized on March 17, 1891. It was named for Gail Borden, Jr., a prominent early Texan.

Gail, the county seat, was established in 1891.

In 1880 the county had a population of 35, and by 1890 it had increased to 222. In 1960 the total population of the county was 1,076.

Farming

Cattle ranching and dryland and irrigation farming are the chief enterprises in Borden County.

Cattle ranching began about 1875 in Borden County, where the availability of cheap land and good grass made livestock raising especially suitable. About 1890 to 1900, small areas of land were cultivated. Kafir and milo were the most important crops.

Today cattle ranching is still the main enterprise. In 1969 there were approximately 18,000 cattle, 12,000 sheep, and 1,600 hogs in Borden County.

Livestock operations are primarily cow-calf. Supplemental feeding is generally heavy, and stock is fed from December to late in February or March. Calves are often sold on a contract basis and are delivered late in spring or early in summer.,

Cotton and grain sorghum are grown on medium to large, fully mechanized farms. Raising livestock is a minor enterprise on these farms.

Climate

Borden County has a warm-temperate, subtropical climate characterized by dry winters and humid summers. Rainfall averages 17.37 inches annually (table 9). In an average year four-fifths of this amount falls mostly during thundershowers in the warm season, April through October. During the colder months of the year, November through March, frequent surges of cold, dry polar air are effective in blocking moisture from the Gulf of Mexico, which limits precipitation. Thundershower activity in West Texas is extremely variable, and large differences in the amount of rainfall exist from year to year and within relatively small geographic areas. The wettest year on record at Gail was 1941, when a total of 34.13 inches of rain fell, and the driest year was 1956, when only 6.67 inches fell.

The prevailing winds across Borden County are southerly from April through October and south-southwesterly from November through March. The average relative humidity, registered at noon, is 49 percent in January, 40 percent in April, 45 percent in July, and 45 percent in October. The percentage of

[6] By ROBERT B. ORTON, climatologist for Texas, National Weather Service, U.S. Department of Commerce.

possible sunshine received in Borden County in an average year is 67 percent in winter, 72 percent in spring, 78 percent in summer, and 72 percent in fall.

During winter frequent surges of cold Polar-Canadian air bring strong northerly winds and rapid drops in temperature. However, cold spells are short, rarely lasting longer than 48 hours before sunshine and southwesterly winds bring rapid warming. Precipitation is as light rain or drizzle, freezing rain, or snow flurries. Because of snow drifting, runoff from snow melt is not evenly distributed over the soil surface.

Spring is a season of frequent weather changes. Warm and cold spells follow each other in rapid succession throughout March and April, and infrequently strong and persistent southwesterly to northwesterly winds produce duststorms in the area during these months. Thunderstorms, which rarely occur in winter, increase in number until late in spring. A few thunderstorms late in spring and early in summer may be accompanied by damaging winds and hail or by excessive downpours that erode the soil.

The climate is drier in summer than late in spring or early in fall. Although the air contains an adequate supply of moisture, few cool fronts penetrate the area during this season; consequently, the triggering mechanism that causes thundershowers to develop is often absent. Early in fall, September and October, rainfall increases again as cool fronts move frequently into the area. At the same time, an adequate flow of moisture-laden air from the Gulf of Mexico is present. Rainfall decreases progressively from September through November.

The freeze-free period in Borden County averages 214 days. The average dates of the last occurrence in spring and the first occurrence in fall of 32° F. or below are April 6 and November 6, respectively.

Natural Resources

Soil is the most important natural resource in the county. The soils are mainly used to produce forage for livestock, food, and fiber.

Oil and gas, produced from numerous wells in the county, are a major source of income for some landowners and serve as a solid tax base for revenue to operate public facilities.

Water is another natural resource. Lake J. B. Thomas furnishes water for several surrounding cities and provides good recreational facilities. Supplemental irrigation of crops is supplied by several wells.

Wildlife in the area provides recreation for many residents.

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Glossary

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Caliche. A more or less cemented deposit of calcium carbonate in many soils of warm-termperate areas, as in the Southwestern States. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum, or it may be exposed at the surface by erosion.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate.
Synonyms: clay coat, clay skin.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

TABLE 9. *Temperature*

[All data from Gail; elevation 2,500 ft.;

Month	Temperature [1]				Precipitation			
	Average daily maximum	Average maximum	Average daily minimum	Average minimum	Average total [2]	Probability of receiving—		
						0 or trace	0.5 inch or more	1 inch or more
	°F	°F	°F	°F	*Inches*	*Percent*	*Percent*	*Percent*
January	59.6	77.7	32.4	12.8	0.55	10	48	27
February	59.7	76.5	32.7	17.7	.48	13	48	25
March	68.0	84.8	40.6	19.2	.79	10	45	23
April	79.5	91.8	53.1	37.7	1.46	<1	70	45
May	85.3	101.0	59.5	45.3	2.72	<1	95	90
June	91.5	101.5	66.2	54.8	1.91	1	83	65
July	96.1	102.0	70.7	63.0	1.97	1	80	68
August	93.0	102.2	68.2	59.2	1.62	3	77	55
September	85.1	96.7	61.4	48.0	2.35	10	74	60
October	78.3	93.5	51.1	37.8	2.17	4	82	82
November	69.5	85.3	43.2	27.2	.80	20	45	25
December	60.1	77.7	33.8	18.3	.55	10	50	29
Year	77.1		51.1		17.37			

[1] For the period 1964–1969.
[2] Average length of record, 18 years.
[3] Average length of record, 13 years.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard and brittle; little affected by moistening.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.
Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.
Well-drained soils are nearly free from mottling and are commonly of intermediate texture.
Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.
Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.
Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.
Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Gilgai. Typically, the microrelief of Vertisols—clayey soils that have a high coefficient of expansion and contraction with changes in moisture; usually a succession of microbasins and microknolls, in nearly level areas, or of microvalleys and microridges that run with the slope.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.
A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).
B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.
C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.
R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border. Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.
Basin.—Water is applied rapidly to relatively level plots surrounded by levees or dikes.
Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.
Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops, or in orchards, to confine the flow of water to one direction.

and precipitation

based on data for the period 1951 1969]

Precipitation—Continued									
Probability of receiving—Continued					Average number of days with [3]—			Snow and sleet [4]	
2 inches or more	3 inches or more	4 inches or more	5 inches or more	6 inches or more	0.1 inch or more	0.5 inch or more	1 inch or more	Average total	Maximum monthly
Percent	*Percent*	*Percent*	*Percent*	*Percent*				*Inches*	*Inches*
9	3	[5] <1	<1	<1	2	([6])	([6])	0.7	5
7	2	<1	<1	<1	2	([6])	0	.3	3
5	2	<1	<1	<1	2	1	([6])	.1	2
20	8	4	2	<1	2	1	([6])	0	0
65	45	25	20	10	4	2	1	0	0
40	25	15	8	5	4	2	1	0	0
41	21	11	10	5	4	1	1	0	0
33	15	8	5	3	3	1	([6])	0	0
35	22	15	8	4	4	2	1	0	0
40	21	11	7	4	3	2	([6])	0	0
8	4	1	<1	<1	2	1	([6])	.4	4
10	4	1	<1	<1	1	1	([6])	.3	4.5
								1.8	5

[1] Average length of record, 16 years.
[5] The symbol < means less than.
[6] Less than one-half day.

Furrow.—Water is applied in small ditches made by cultivation implements used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Irrigation water, released at high points, flows onto the field without controlled distribution.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on relatively steep slopes and in swelling clays, where there is marked change in mosture content.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

GUIDE TO MAPPING UNITS

For complete information about a mapping unit, read both the description of the mapping unit and that of the soil series to which it belongs. In referring to a capability unit, a range site, or a wildlife group, read the introduction to the section it is in for general information about its management. Dashes in columns mean that the mapping unit was not placed in that particular grouping. Other information is given in tables as follows:

Acreage and extent, table 1, p. 8.
Estimated yields, table 2, p. 36.

Engineering uses of the soils, tables 5, 6, and 7, pp. 50 through 63.

Map symbol	Mapping unit	Page	Capability unit Dryland Symbol	Dryland Page	Irrigated Symbol	Irrigated Page	Range site Name	Range site Page
AcA	Acuff loam, 0 to 1 percent slopes	9	IIIe-1	32	I-2	31	Deep Hardland	38
AcB	Acuff loam, 1 to 3 percent slopes	9	IIIe-3	33	IIe-2	31	Deep Hardland	38
AmA	Amarillo fine sandy loam, 0 to 1 percent slopes	10	IIIe-4	33	IIe-4	32	Sandy Loam	41
AmB	Amarillo fine sandy loam, 1 to 3 percent slopes	10	IIIe-4	33	IIe-3	32	Sandy Loam	41
AmC	Amarillo fine sandy loam, 3 to 5 percent slopes	10	IVe-4	34	IIIe-1	32	Sandy Loam	41
ArB	Arch loam, 0 to 3 percent slopes	10	IVe-3	34	(1/)	----	High Lime	39
Ba	Badland	11	VIIIe-1	36	------	----	(2/)	----
BeB	Berda loam, 1 to 3 percent slopes	12	IIIe-7	33	------	----	Deep Hardland	38
BeC	Berda loam, 3 to 5 percent slopes	12	IVe-2	34	------	----	Deep Hardland	38
BpA	Bippus clay loam, 0 to 1 percent slopes	12	IIe-2	32	------	----	Deep Hardland	38
BpB	Bippus clay loam, 1 to 3 percent slopes	12	IIIe-2	33	------	----	Deep Hardland	38
Br	Brownfield fine sand	13	VIe-3	35	------	----	Deep Sand	39
Co	Colorado and Spur soils	13	Vw-1	35	------	----	Bottomland	37
EsA	Estacado clay loam, 0 to 1 percent slopes	14	IIIe-1	32	I-2	31	Deep Hardland	38
EsB	Estacado clay loam, 1 to 3 percent slopes	14	IIIe-3	33	IIe-2	31	Deep Hardland	38
Km	Kimbrough soils	15	VIIs-1	35	------	----	Very Shallow	42
La	Latom soils	15	VIIs-1	35	------	----	Very Shallow	42
Ln	Lipan clay	15	IVw-1	35	------	----	----------	----
Lo	Lofton clay loam	16	IIIe-5	33	IIs-1	32	Deep Hardland	38
Ma	Mangum clay	16	IIIs-1	34	------	----	Clay Flats	38
Mc	Mangum clay, channeled	17	VIs-2	35	------	----	Clay Flats	38
MoB	Mobeetie fine sandy loam, 1 to 3 percent slopes	17	IIIe-8	33	------	----	Sandy Loam	41
OcA	Olton clay loam, 0 to 1 percent slopes	18	IIIe-1	32	I-1	31	Deep Hardland	38
OcB	Olton clay loam, 1 to 3 percent slopes	18	IIIe-2	33	IIe-1	31	Deep Hardland	38
PaB	Patricia loamy fine sand, 0 to 3 percent slopes	19	IVe-6	34	------	----	Sandyland	40
PfB	Patricia fine sandy loam, 1 to 3 percent slopes	19	IIIe-4	33	IIe-3	32	Sandy Loam	41
Po	Polar soils	20	VIs-1	35	------	----	Gravelly	39
PsB	Posey loam, 1 to 3 percent slopes	21	IIIe-7	33	IIIe-3	33	Deep Hardland	38
PsC	Posey loam, 3 to 5 percent slopes	21	IVe-2	34	------	----	Deep Hardland	38
Pt	Potter soils	22	VIIs-1	35	------	----	Very Shallow	42
Ro	Rough broken land	22	VIIs-2	35	------	----	Rough Breaks	40
RrA	Rowena-Rotan complex, 0 to 1 percent slopes	23	IIe-2	32	I-1	31	Deep Hardland	38
RrB	Rowena-Rotan complex, 1 to 3 percent slopes	23	IIIe-2	33	IIe-1	31	Deep Hardland	38
ShB	Sharvana fine sandy loam, 0 to 1 percent slopes	24	IVs-1	35	IVs-1	35	Sandy Loam	41
SlC	Spade-Latom complex, 2 to 5 percent slopes	25	VIe-2	35	------	----	----------	----
	Spade part	----	------	----	------	----	Sandy Loam	41
	Latom part	----	------	----	------	----	Very Shallow	42
Sp	Spur clay loam	25	IIe-1	31	I-2	31	Valley	41
StA	Stamford clay, 0 to 1 percent slopes	26	IIIs-1	34	------	----	Clay Flats	38
StB	Stamford clay, 1 to 3 percent slopes	26	IVe-8	34	------	----	Clay Flats	38
SuA	Stegall-Slaughter complex, 0 to 1 percent slopes	27	IIIe-6	33	I-1	31	Deep Hardland	38
VaB	Veal fine sandy loam, 1 to 3 percent slopes	27	IVe-1	34	IIIe-2	32	Sandy Loam	41

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Map symbol	Mapping unit	Page	Capability unit Dryland Symbol	Dryland Page	Irrigated Symbol	Irrigated Page	Range site Name	Range site Page
VaC	Veal fine sandy loam, 3 to 5 percent slopes----	28	IVe-5	34	------	----	Sandy Loam	41
VbD	Veal-Potter complex, 1 to 8 percent slopes-----	28	VIe-2	35	------	----	----------	----
	Veal part----------	----	------	----	------	----	Deep Hardland	38
	Potter part----------	----	------	----	------	----	Very Shallow	42
VcB	Vernon clay, 1 to 3 percent slopes----------	29	IVe-3	34	------	----	Shallow Redland	41
VcE	Vernon clay, 3 to 12 percent slopes----------	29	VIe-1	35	------	----	Shallow Redland	41
Ve	Vernon-Badland complex----------	29	VIs-1	35	------	----	Shallow Redland	41
VpF	Vernon-Potter complex, 2 to 30 percent slopes--	29	VIs-1	35	------	----	----------	----
	Vernon part----------	----	------	----	------	----	Shallow Redland	41
	Potter part----------	----	------	----	------	----	Very Shallow	42
WvB	Weymouth-Vernon complex, 1 to 3 percent slopes----------	30	IVe-7	34	------	----	Shallow Redland	41

1/ Not irrigated or not suitable to irrigate.

2/ Included with surrounding range sites.

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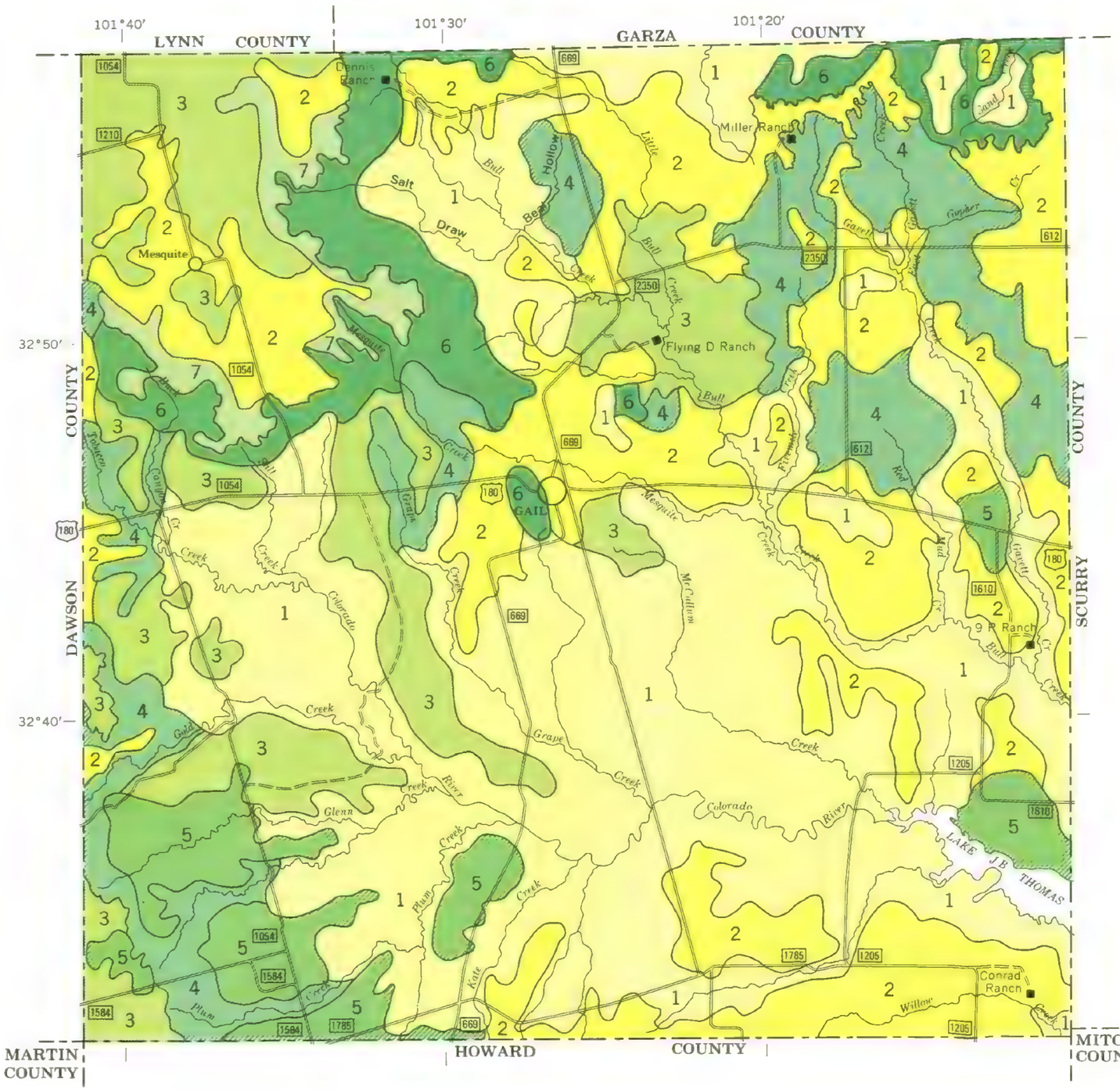

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
BORDEN COUNTY, TEXAS

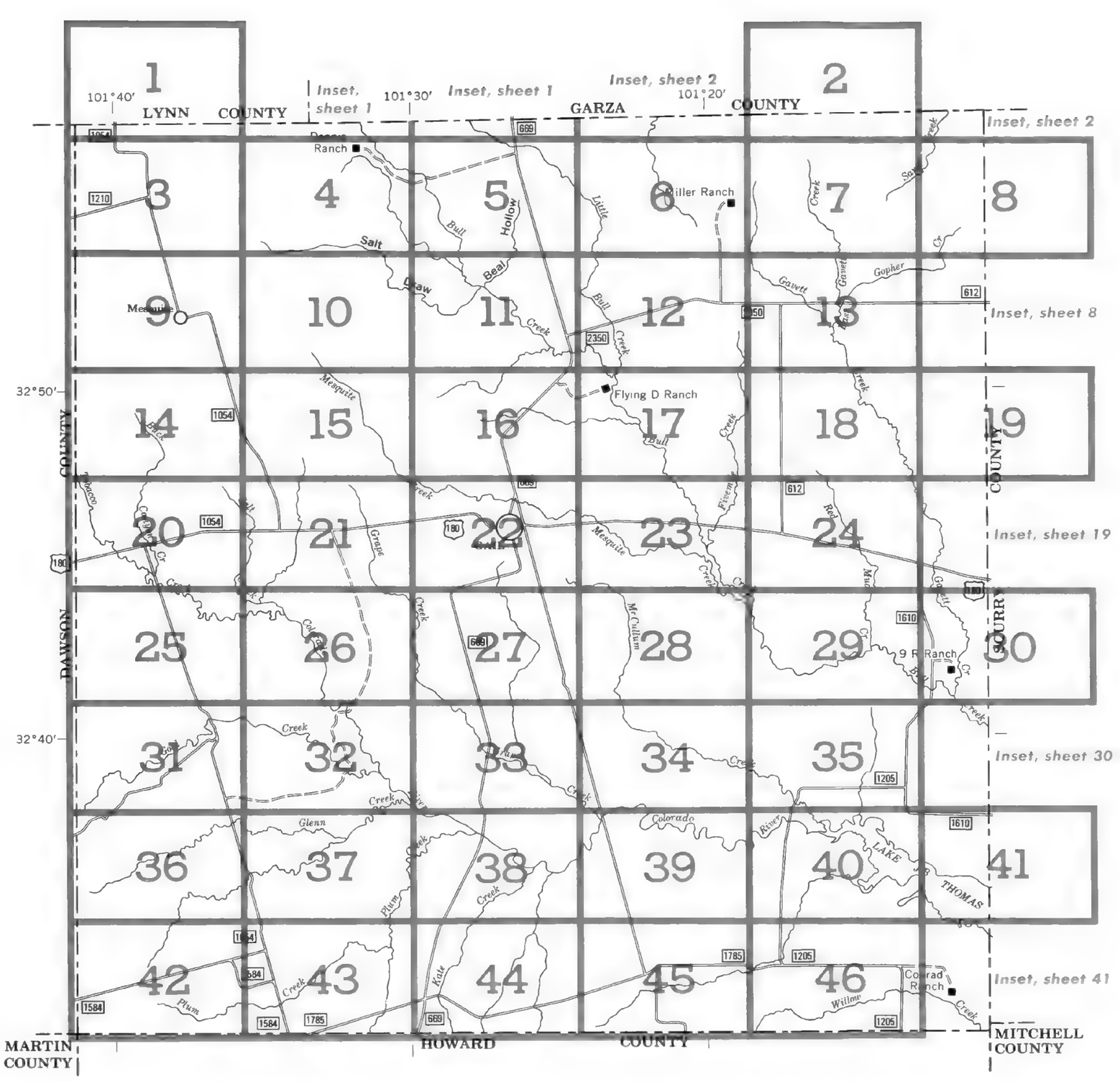
Scale 1:253,440
1 0 1 2 3 4 Miles

SOIL ASSOCIATIONS

1. Vernon-Weymouth-Stamford association: Moderately deep to deep soils that are clay or clay loam throughout
2. Olton-Rowena-Rotan association: Deep soils that have a clay loam surface layer over clay
3. Estacado-Acuff association: Deep soils that have a loam or clay loam surface layer over clay loam or sandy clay loam
4. Potter-Posey association: Very shallow to deep soils that have a loam surface layer over caliche or clay loam
5. Patricia-Veal association: Deep soils that have a fine sandy loam surface layer over sandy clay loam
6. Berda-Rough broken land association: Deep soils that have a loam surface layer over clay loam; and Rough broken land
7. Kimbrough association: Shallow to very shallow soils that have a loam surface layer over indurated caliche

Compiled 1973

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



N

INDEX TO MAP SHEETS

BORDEN COUNTY, TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, shows the slope. Most symbols without a slope letter are those of nearly level soils but some are for soils and land types that have a considerable range of slope. (W) following the soil name indicates that signs of erosion, especially of local shifting of soil by wind, are evident in places, but the degree of erosion cannot be estimated reliably.

SYMBOL	NAME
AcA	Acuff loam, 0 to 1 percent slopes
AcB	Acuff loam, 1 to 3 percent slopes
AmA	Amarillo fine sandy loam, 0 to 1 percent slopes
AmB	Amarillo fine sandy loam, 1 to 3 percent slopes
AmC	Amarillo fine sandy loam, 3 to 5 percent slopes
ArB	Arch oam, 0 to 3 percent slopes
Ba	Badland
BeB	Berda loam, 1 to 3 percent slopes
BeC	Berda loam, 3 to 5 percent slopes
BpA	Bippus clay loam, 0 to 1 percent slopes
BpB	Bippus clay loam, 1 to 3 percent slopes
Br	Brownfield fine sand (W)
Co	Colorado and Spur soils *
EsA	Estacado clay oam, 0 to 1 percent slopes
EsB	Estacado clay loam, 1 to 3 percent slopes
Km	Kimbrough soils
La	Latom soils
Ln	Lipan clay
Lo	Lofton clay loam
Ma	Mangum clay
Mc	Mangum clay, channeled
MoB	Mobeetie fine sandy loam, 1 to 3 percent slopes
OcA	Olton clay loam, 0 to 1 percent slopes
OcB	Olton clay loam, 1 to 3 percent slopes
PaB	Patricia loamy fine sand, 0 to 3 percent slopes (W)
PfB	Patricia fine sandy loam, 1 to 3 percent slopes
Po	Polar soils
PsB	Posey loam, 1 to 3 percent slopes
PsC	Posey loam, 3 to 5 percent slopes
Pt	Potter soils
Ro	Rough broken land
RrA	Rowena-Rotan complex, 0 to 1 percent slopes
RrB	Rowena-Rotan complex, 1 to 3 percent slopes
ShB	Sharvana fine sandy loam, 0 to 3 percent slopes
SlC	Spade-Latom complex, 2 to 5 percent slopes
Sp	Spur clay loam
StA	Stamford clay, 0 to 1 percent slopes
StB	Stamford clay, 1 to 3 percent slopes
SuA	Stegall-Slaughter complex, 0 to 1 percent slopes
VaB	Veal fine sandy loam, 1 to 3 percent slopes
VaC	Veal fine sandy loam, 3 to 5 percent slopes
VbD	Veal-Potter complex, 1 to 8 percent slopes
VcB	Vernon clay, 1 to 3 percent slopes
VcE	Vernon clay, 3 to 12 percent slopes
Ve	Vernon-Badland complex
VpF	Vernon-Potter complex, 2 to 30 percent slopes
WvB	Weymouth-Vernon complex, 1 to 3 percent slopes

* The delineations are much larger and the composition of these units is more variable than other map units in the county. Mapping has been controlled well enough, however, for the anticipated use of the soils.

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Caliche pit

Power line

Pipeline

Cemetery

Dams

Levee

Fence

Well, oil or gas

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
- Unclassified

Canals and ditches

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

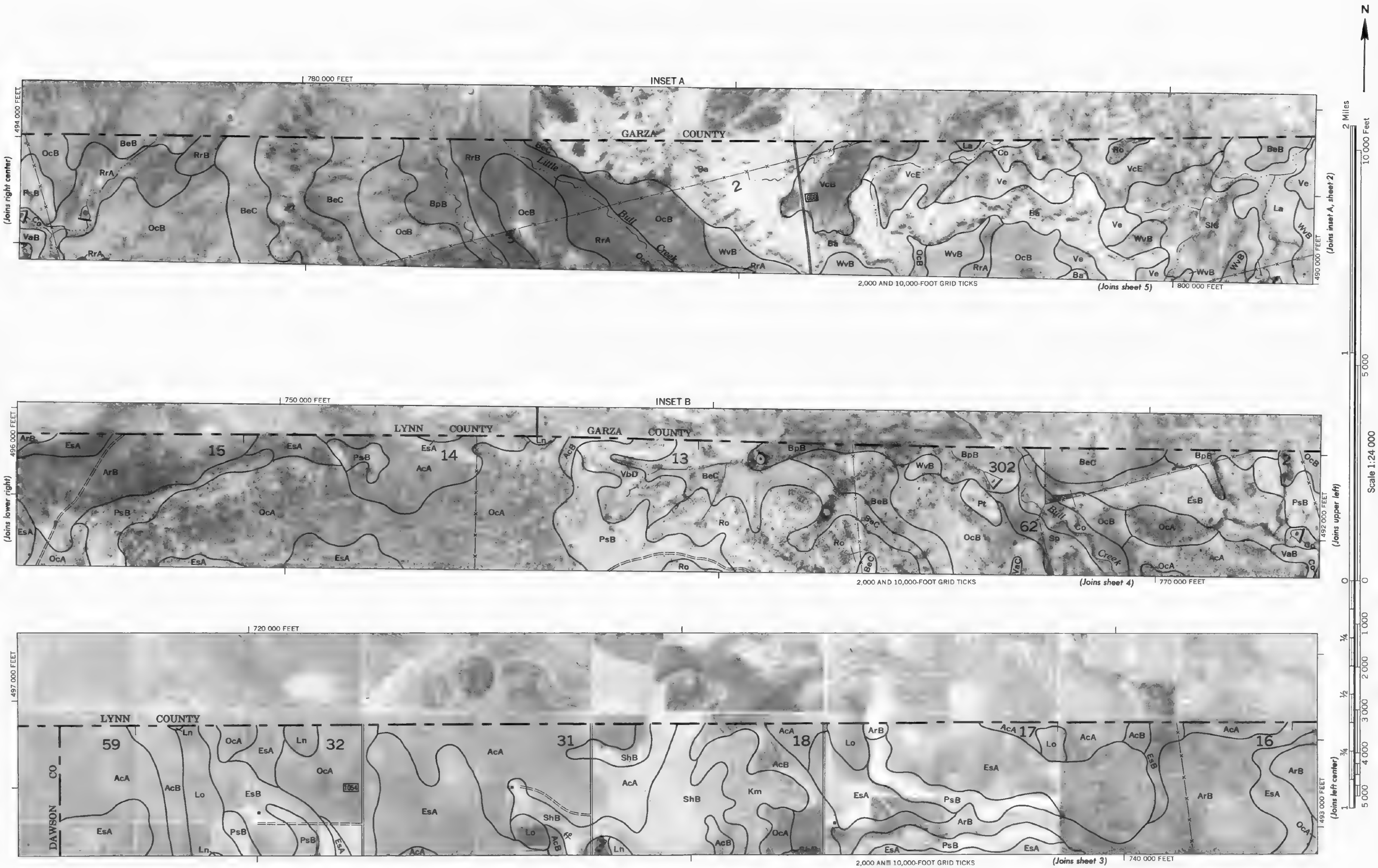
Prominent peak

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

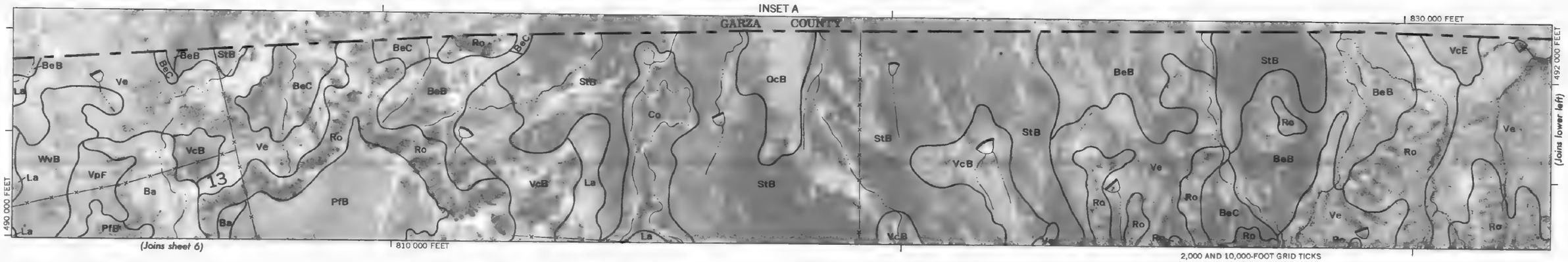
- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully

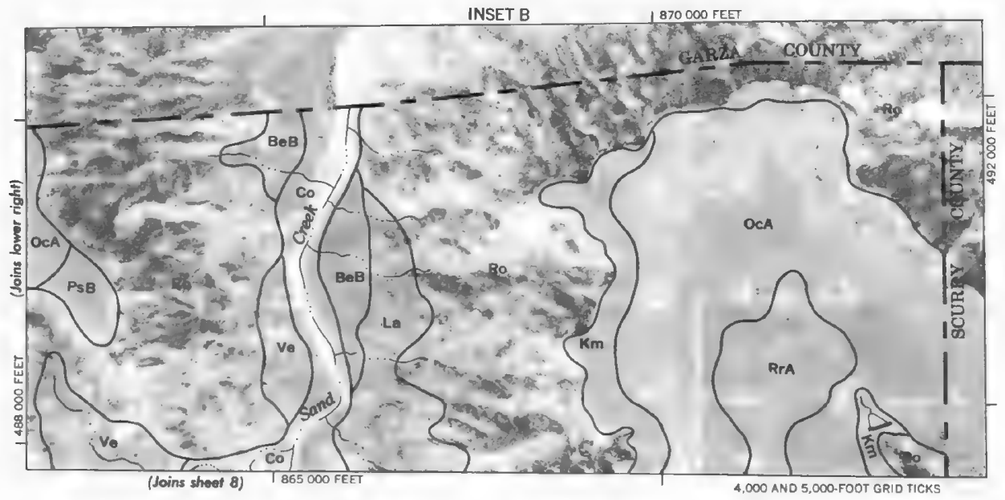


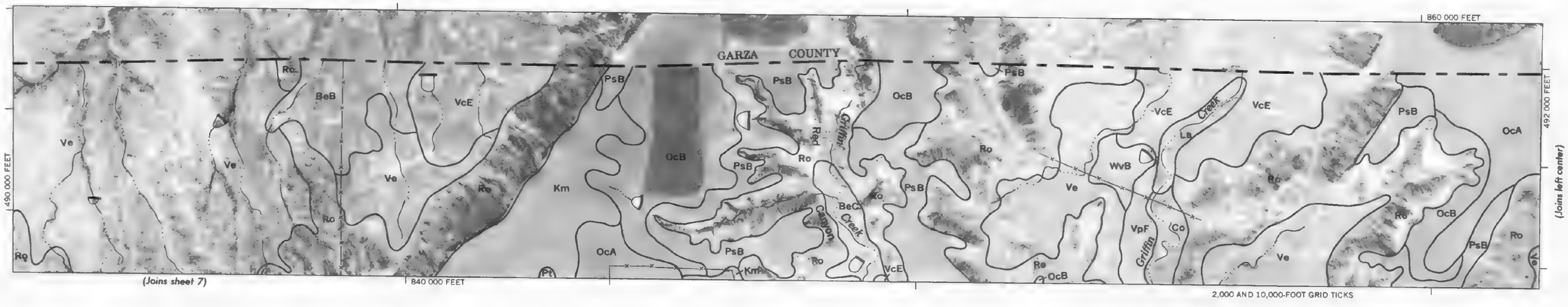
BORDEN COUNTY, TEXAS NO. 1

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

BORDEN COUNTY, TEXAS — SHEET NUMBER 2







N

2 Miles

10 000 Feet

Scale 1:24 000

1 5 000 0

¼ 2 000 1 000

½ 3 000 2 000

¾ 4 000 3 000

1 5 000 0

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

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BORDEN COUNTY, TEXAS NO. 2

BORDEN COUNTY, TEXAS — SHEET NUMBER 3

BORDEN COUNTY, TEXAS NO. 3

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Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
10,000-foot grid ticks are approximately positioned on this map.
Land division corners are approximately positioned on this map.

720 000 FEET

490 000 FEET

480 000 FEET

740 000 FEET

(Joins sheet 1)

(Joins sheet 4)

(Joins sheet 9)

DAWSON COUNTY

Berry Flat Church

1054

1210

N

2 Miles

10 000 Feet

5 000

Scale 1:24 000

BORDEN COUNTY, TEXAS — SHEET NUMBER 4

(Joins inset B, sheet 1)

770 000 FEET

490 000 FEET

(Joins sheet 3)

(Joins sheet 5)

480 000 FEET

(Joins sheet 10)

750 000 FEET

N

2 Miles

10 000 Feet

Scale 1:24 000

1 5 000 0

¼ 1 000

½ 2 000

¾ 4 000

1 5 000

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

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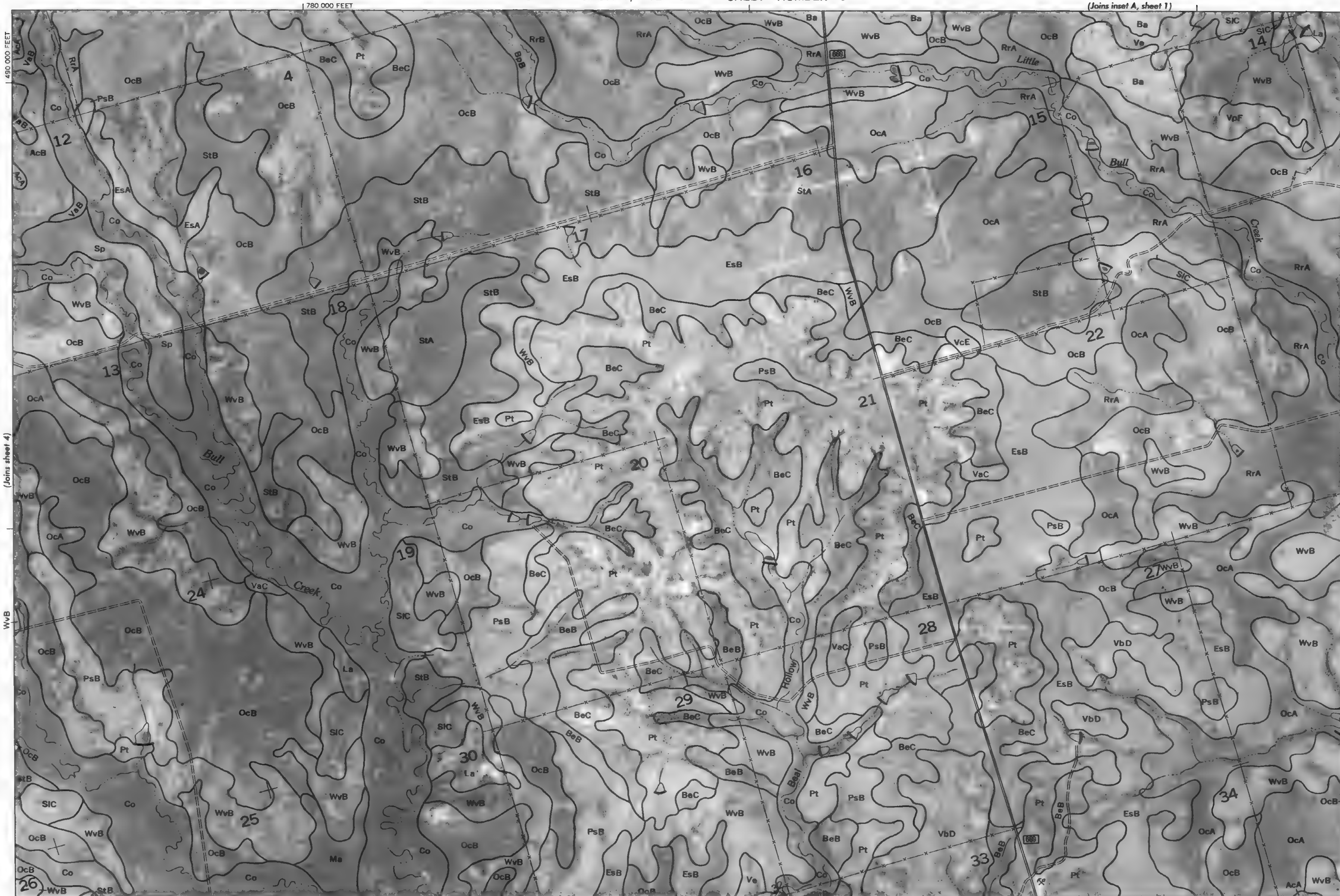
BORDEN COUNTY, TEXAS NO. 4

(5)



N

Scale 1:24 000

2 Miles | 1 | 0 | ¼ | ½ | ¾ | 1

10 000 Feet | 5000 | 0 | 1000 | 2000 | 3000 | 4000 | 5000

BORDEN COUNTY, TEXAS NO. 5

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

(6)

N

(Joins inset A, sheet 2)

830 000 FEET

480 000 FEET

(Joins sheet 5)

(Joins sheet 7)

(Joins sheet 12)

810 000 FEET

Scale 1:24 000

2 Miles 1 0

10 000 Feet 5 000 0

1 5 000

¼ 1 000

½ 2 000

¾ 4 000

1 5 000

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

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BORDEN COUNTY, TEXAS NO. 6

BORDEN COUNTY, TEXAS — SHEET NUMBER 7

BORDEN COUNTY, TEXAS NO. 7

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Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map

840 000 FEET

480 000 FEET

470 000 FEET

460 000 FEET

(Joins sheet 2)

(Joins sheet 6)

(Joins sheet 8)

(Joins sheet 13)

7

N

2 Miles

10 000 Feet

5 000

1

0

1 000

2 000

3 000

4 000

5 000

Scale 1:24 000

(8)

N

2 Miles 10 000 Feet

1 5 000

Scale 1:24 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

(Joins inset B, sheet 2) 870 000 FEET

(Joins lower left) 870 000 FEET

480 000 FEET

460 000 FEET

470 000 FEET

450 000 FEET

(Joins sheet 7)

(Joins upper right) 865 000 FEET

(Joins sheet 19) 865 000 FEET

5,000 AND 10,000-FOOT GRID TICKS

5,000 AND 10,000-FOOT GRID TICKS

SCURRY COUNTY

SCURRY COUNTY

596 597 581 580 534 535 518 519 480 481 465 464 424 425 409 408

Jones Reservoir

Gopher Creek

Sand Creek

Ro Co La VcE Ve Km BeB VcB OcA RrA PsB Ln Pt BeC OcB EsA EsB PsC RrB Lo

612 612

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

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BORDEN COUNTY, TEXAS NO. 8

BORDEN COUNTY, TEXAS — SHEET NUMBER 9

BORDEN COUNTY, TEXAS NO. 9

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Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

720 000 FEET

470 000 FEET

460 000 FEET

740 000 FEET

(Joins sheet 3)

(Joins sheet 10)

(Joins sheet 14)

DAWSON COUNTY

Mesquite

105

16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 39

AcA AcB BeC EsA EsB Km Ln Lo OcA OcB PsB Ro SuA

9

N

2 Miles

10 000 Feet

1 5 000

Scale 1:24 000

1 5 000 0 0

¾ 4 000 1 000

½ 3 000 2 000

¼ 2 000 3 000

0 1 000 4 000

0 5 000

BORDEN COUNTY, TEXAS — SHEET NUMBER 10

N

2 Miles

10 000 Feet

Scale 1:24 000

1 5 000 0 1 000 2 000 3 000 4 000 5 000

1/4 1/2 3/4

(Joins sheet 4)

770 000 FEET

1 470 000 FEET

(Joins sheet 9)

(Joins sheet 11)

450 000 FEET

(Joins sheet 15)

750 000 FEET

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

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BORDEN COUNTY, TEXAS — SHEET NUMBER 11

780 000 FEET

470 000 FEET

460 000 FEET

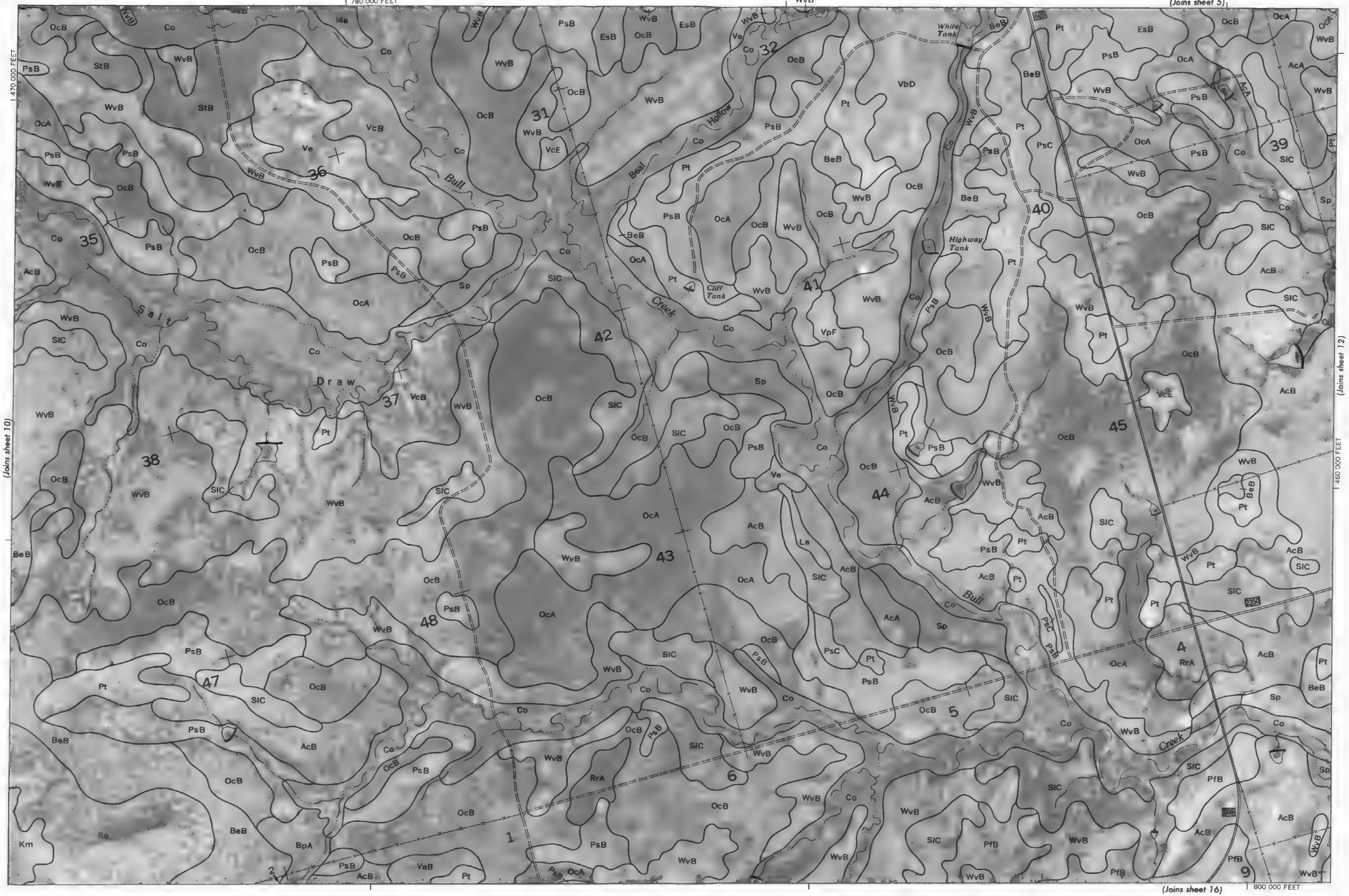
800 000 FEET

(Joins sheet 10)

(Joins sheet 5)

(Joins sheet 12)

(Joins sheet 16)



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Land division corners are approximately positioned on this map.

11

N

2 Miles

10 000 Feet

1:24 000

Scale 1:24 000

BORDEN COUNTY, TEXAS — SHEET NUMBER 12

(12)

N

(Joins sheet 6)

830 000 FEET

460 000 FEET

(Joins sheet 11)

(Joins sheet 13)

810 000 FEET

(Joins sheet 17)

Scale 1:24 000

2 Miles 10 000 Feet

1 5 000 0

¼ 1 000 0

½ 2 000

¾ 4 000

1 5 000

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone

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BORDEN COUNTY, TEXAS — SHEET NUMBER 13

BORDEN COUNTY, TEXAS NO. 13

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Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

840 000 FEET

(Joins sheet 7)

(Joins sheet 12)

460 000 FEET

(Joins sheet, sheet 8)

(Joins sheet 18)

860 000 FEET

450 000 FEET

13

N

2 Miles

1

10 000 Feet

5 000

Scale 1:24 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

1¼ 5 000

BORDEN COUNTY, TEXAS — SHEET NUMBER 14

(14)

N

(Joins sheet 9)

740 000 FEET

450 000 FEET

720 000 FEET

(Joins sheet 20)

(Joins sheet 15)

DAWSON COUNTY

Indian Canyon

Buck Canyon Creek

Scale 1:24 000

2 Miles

10 000 Feet

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

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BORDEN COUNTY, TEXAS NO. 15

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Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

750 000 FEET

450 000 FEET

(Joins sheet 10)

(Joins sheet 14)

(Joins sheet 16)

(Joins sheet 21)

440 000 FEET

770 000 FEET

Holloway Canyon

Mesquite Creek

15

N

2 Miles

10 000 Feet

Scale 1:24 000

(Joins sheet 11)

800 000 FEET

450 000 FEET

N

2 Miles

10 000 Feet

1

5 000

Scale 1:24 000

0 0

¼ 1 000

½ 2 000

¾ 4 000

1 5 000

(Joins sheet 15)

440 000 FEET

(Joins sheet 17)

(Joins sheet 22)

780 000 FEET

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone

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BORDEN COUNTY, TEXAS — SHEET NUMBER 17

BORDEN COUNTY, TEXAS NO. 17

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Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

810 000 FEET

1 450 000 FEET

(Joins sheet 12)

(Joins sheet 16)

(Joins sheet 18)

(Joins sheet 23)

830 000 FEET

1 440 000 FEET

17

N

2 Miles

10 000 Feet

Scale 1:24 000

5 000 0 1 000 2 000 3 000 4 000 5 000

(Joins sheet 13)

860 000 FEET

N

2 Miles

10 000 Feet

1 5 000 0 1 000 2 000 3 000 4 000 5 000

Scale 1:24 000

440 000 FEET

(Joins sheet 17)

(Joins sheet 19)

830 000 FEET

(Joins sheet 24)

Land division corners are approximately positioned on this map.

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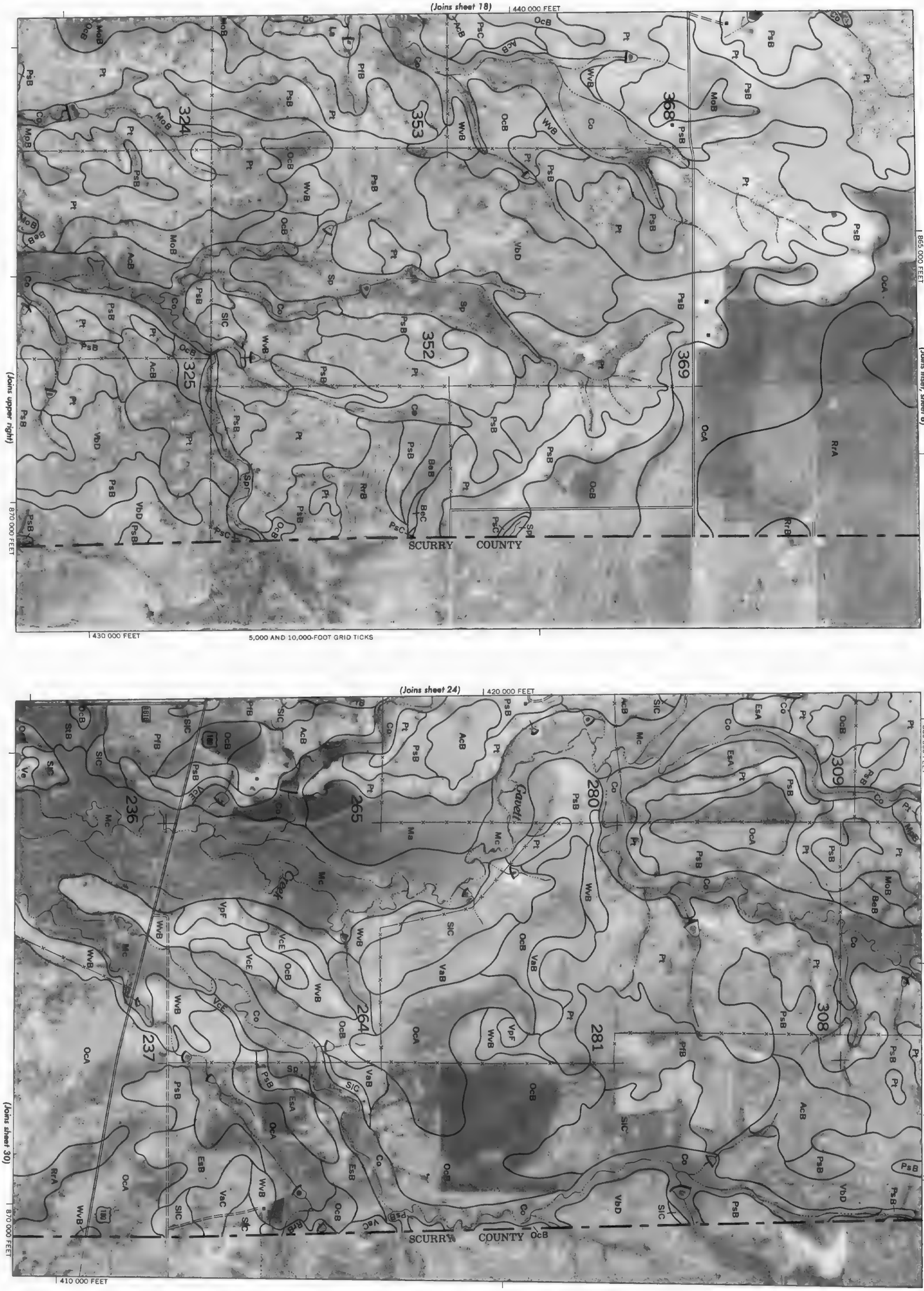
Land division corners are approximately positioned on this map.



BORDEN COUNTY, TEXAS — SHEET NUMBER 19

20

N

2 Miles

10 000 Feet

1

5 000

1:24 000

Scale 1:24 000

0 0

¼ 1 000

½ 2 000

¾ 4 000

1 5 000

(Joins sheet 14)

740 000 FEET

430 000 FEET

420 000 FEET

720 000 FEET

(Joins sheet 21)

(Joins sheet 25)

DAWSON COUNTY

Buck Creek

Canyon

Tobacco Creek

Salt Creek

180

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

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BORDEN COUNTY, TEXAS — SHEET NUMBER 21

BORDEN COUNTY, TEXAS NO. 21

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Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

750 000 FEET

430 000 FEET

420 000 FEET

770 000 FEET

(Joins sheet 15)

(Joins sheet 20)

(Joins sheet 22)

(Joins sheet 26)

21

N

2 Miles

10 000 Feet

Scale 1:24 000

BORDEN COUNTY, TEXAS — SHEET NUMBER 22

22

N

(Joins sheet 16)

300 000 FEET

430 000 FEET

(Joins sheet 21)

(Joins sheet 23)

420 000 FEET

780 000 FEET

(Joins sheet 27)

Scale 1:24 000

2 Miles 1 0

10 000 Feet 5 000 0

1 000 2 000 3 000 4 000 5 000

¼ ½ ¾ 1

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

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BORDEN COUNTY, TEXAS — SHEET NUMBER 23

BORDEN COUNTY, TEXAS NO. 23

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Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

810 000 FEET

1 430 000 FEET

(Joins sheet 17)

(Joins sheet 22)

(Joins sheet 24)

820 000 FEET

(Joins sheet 28)

1 420 000 FEET

Creek

Mesquite

Fivemile

Bull

Creek

Creek

N

Scale 1:24 000

2 Miles

10 000 Feet

BORDEN COUNTY, TEXAS — SHEET NUMBER 24

(24)

N

Scale 1:24 000

2 Miles 1 0

10 000 Feet 5 000 0

1 ¼ ½ ¾ 1

5 000 4 000 3 000 2 000 1 000 0

(Joins sheet 18)

(Joins sheet 23)

(Joins sheet 29)

(Joins inset, sheet 19)

850 000 FEET

830 000 FEET

420 000 FEET

315 314 313 312 311 310

274 275 276 277 278 279

271 270 269 268 267 266

230 231 232 233 234 235

Red Mud Creek

Gauett Creek

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

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BORDEN COUNTY, TEXAS — NO. 24

BORDEN COUNTY, TEXAS — SHEET NUMBER 25

BORDEN COUNTY, TEXAS NO. 25

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

Land division corners are approximately positioned on this map.

720 000 FEET

410 000 FEET

(Joins sheet 20)

(Joins sheet 26)

(Joins sheet 31)

740 000 FEET

400 000 FEET

COUNTY

DAWSON

Tobacco Creek

Salt Creek

25

N

Scale 1:24 000

2 Miles

10 000 Feet

1

5 000

0

1 000

2 000

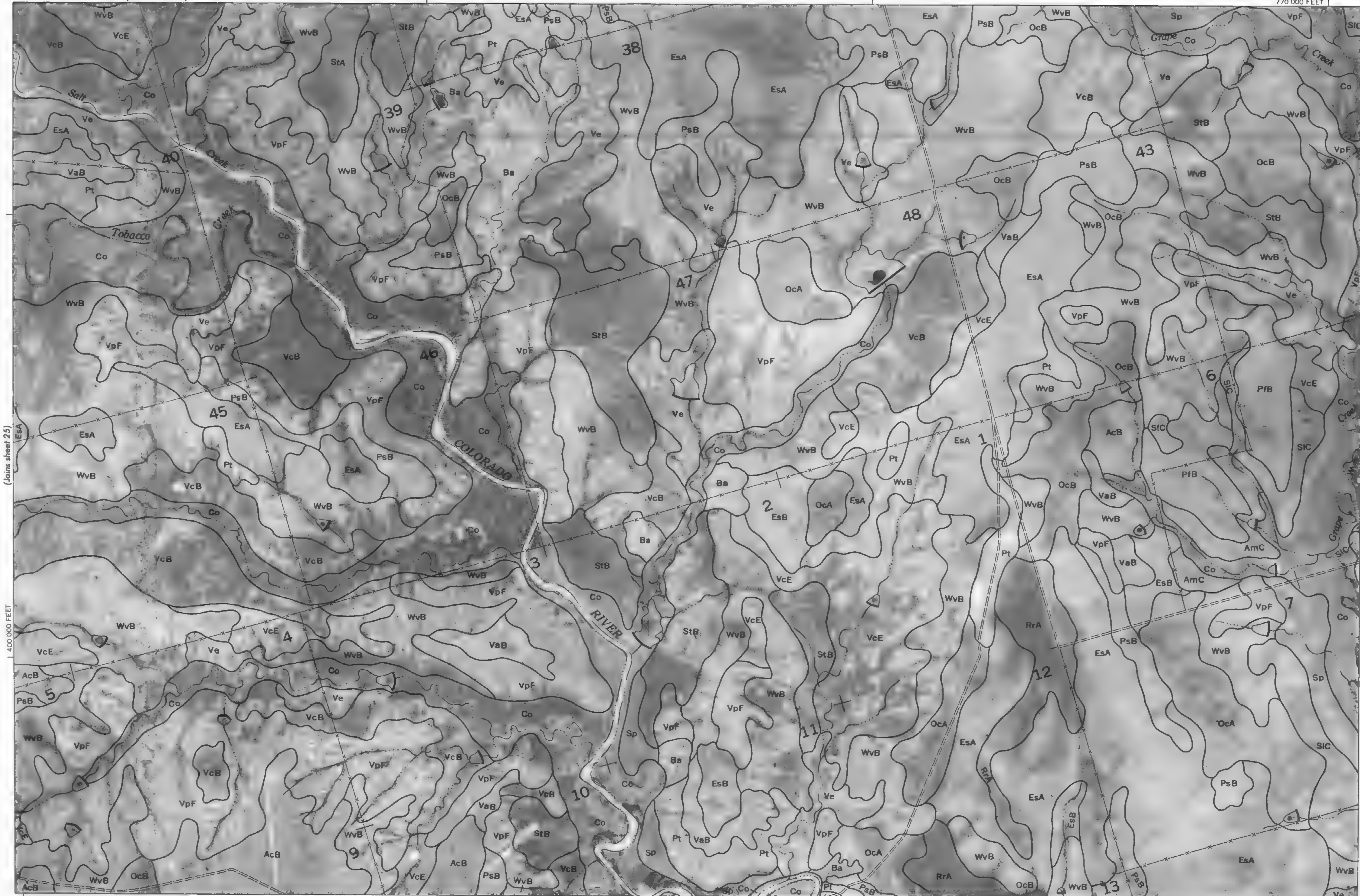
3 000

4 000

5 000

BORDEN COUNTY, TEXAS — SHEET NUMBER 26

N



Scale 1:24 000

2 Miles — 1 — 0 — 1/4 — 1/2 — 3/4 — 1

10 000 Feet — 5 000 — 0 — 1000 — 2000 — 3000 — 4000 — 5000

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

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BORDEN COUNTY, TEXAS — SHEET NUMBER 27

BORDEN COUNTY, TEXAS NO. 27

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Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map

780 000 FEET

410 000 FEET

(Joins sheet 22)

(Joins sheet 26)

(Joins sheet 28)

790 000 FEET

400 000 FEET

(Joins sheet 33)

27

N

2 Miles

10 000 Feet

Scale 1:24 000

1 0 1

5 000 0 5 000

¼ 0 ¼

1 000 0 1 000

½ 0 ½

2 000 0 2 000

¾ 0 ¾

3 000 0 3 000

1 0 1

4 000 0 4 000

5 000 0 5 000

N

Scale 1:24 000

2 Miles 1 0 10 000 Feet

1 0 5 000

1/4 0 1 000

1/2 0 2 000

3/4 0 3 000

1 0 4 000

5 000

(Joins sheet 23)

820 000 FEET

410 000 FEET

400 000 FEET

800 000 FEET

(Joins sheet 27)

(Joins sheet 29)

(Joins sheet 34)

Muchakooago Peak

Mesquite Creek

McCallum Creek

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

BORDEN COUNTY, TEXAS — SHEET NUMBER 29

BORDEN COUNTY, TEXAS NO. 29

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone
Land division corners are approximately positioned on this map.

29

N

2 Miles

1 10 000 Feet

1 5 000 0

Scale 1:24 000

830 000 FEET

410 000 FEET

850 000 FEET

390 000 FEET

(Joins sheet 24)

(Joins sheet 28)

(Joins sheet 30)

(Joins sheet 35)

Bull Creek

Mud Creek

Red Creek

Clear Tank

Wascomb Tank

Wicker Tank

Polly Tank

N

2 Miles 10 000 Feet

Scale 1:24 000

1 5 000 1 000 0 0

½ 2 000 1 000

¾ 4 000 3 000

1 5 000

(Joins inset, sheet 19)

870 000 FEET

(Joins sheet 29)

390 000 FEET

860 000 FEET

(Joins upper right)

400 000 FEET

COUNTY

SCURRY

(Joins lower left)

870 000 FEET

390 000 FEET

380 000 FEET

(Joins sheet 35)

860 000 FEET

(Joins sheet 41)

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

BORDEN COUNTY, TEXAS — SHEET NUMBER 31

720 000 FEET

(Joins sheet 25)

390 000 FEET

DAWSON COUNTY

Gold Creek

CREEK

GOLD

380 000 FEET

730 000 FEET

(Joins sheet 32)

(Joins sheet 36)

N

2 Miles

10 000 Feet

Scale 1:24 000

BORDEN COUNTY, TEXAS NO. 31

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Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

N

2 Miles 10 000 Feet

Scale 1:24 000

1 0 1/4 1 000 1/2 2 000 3/4 3 000 1 4 000 5 000

(Joins sheet 26)

770 000 FEET

390 000 FEET

380 000 FEET

740 000 FEET

(Joins sheet 31)

(Joins sheet 33)

(Joins sheet 37)

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

BORDEN COUNTY, TEXAS — SHEET NUMBER 33

33

N

BORDEN COUNTY, TEXAS NO. 33

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

770 000 FEET

390 000 FEET

380 000 FEET

790 000 FEET

(Joins sheet 27)

(Joins sheet 32)

(Joins sheet 34)

(Joins sheet 38)

Scale 1:24 000

2 Miles 1 0

10 000 Feet 5 000 0

1 000 2 000 3 000 4 000 5 000

BORDEN COUNTY, TEXAS — SHEET NUMBER 34

N

Scale 1:24 000

2 Miles 1 0

10 000 Feet 5 000 0

1 ¼ ½ ¾ 1

5 000 4 000 3 000 2 000 1 000 0

820 000 FEET

390 000 FEET

380 000 FEET

800 000 FEET

(Joins sheet 28)

(Joins sheet 33)

(Joins sheet 35)

(Joins sheet 39)

McCullum Creek

Grape Creek

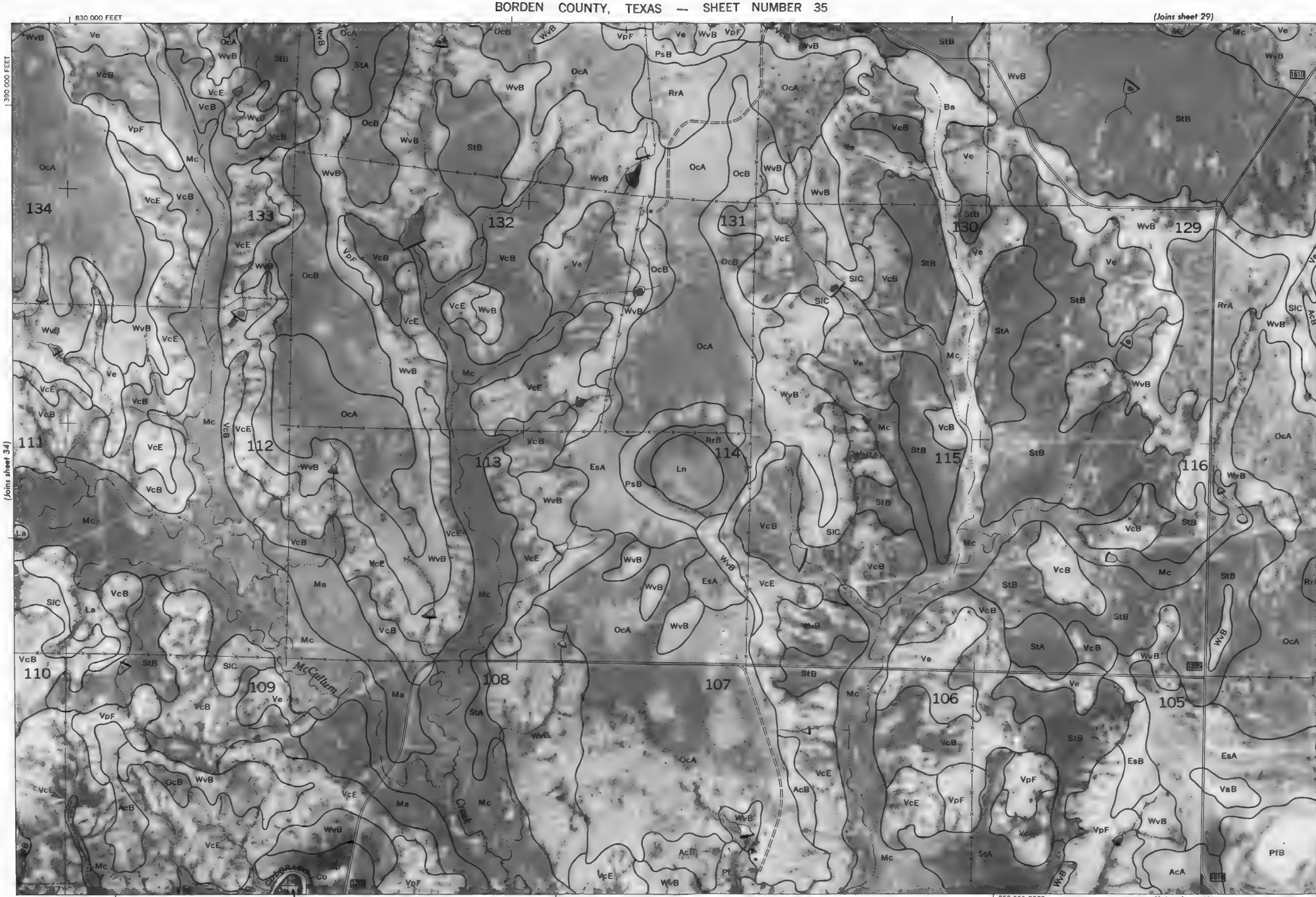
COLORADO RIVER

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

(35)



N

Scale 1:24 000

2 Miles, 1, ¾, ½, ¼, 0

10 000 Feet, 5 000, 0

5 000, 4 000, 3 000, 2 000, 1 000, 0

BORDEN COUNTY, TEXAS NO. 35

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

(Joins sheet 31)

730 000 FEET

370 000 FEET

360 000 FEET

710 000 FEET

(Joins sheet 42)

(Joins sheet 37)

N

2 Miles

10 000 Feet

Scale 1:24 000

1 5 000

¼ 1 000

½ 2 000

¾ 4 000

1 5 000

0 0

DAWSON COUNTY

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

BORDEN COUNTY, TEXAS — SHEET NUMBER 37

BORDEN COUNTY, TEXAS NO. 37

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

740 000 FEET

370 000 FEET

360 000 FEET

760 000 FEET

(Joins sheet 32)

(Joins sheet 36)

(Joins sheet 43)

(Joins sheet 38)

37

N

2 Miles

10 000 Feet

Scale 1:24 000

Glenn Creek

Plum Creek

BORDEN COUNTY, TEXAS — SHEET NUMBER 38

(38)

N

(Joins sheet 33)

790 000 FEET

370 000 FEET

(Joins sheet 37)

(Joins sheet 39)

360 000 FEET

770 000 FEET

(Joins sheet 44)

Scale 1:24 000

2 Miles 1 0

10 000 Feet 5 000 0

¼ ½ ¾ 1

1 000 2 000 3 000 4 000 5 000

Land division corners are approximately positioned on this map

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station

BORDEN COUNTY, TEXAS — SHEET NUMBER 39

800 000 FEET

370 000 FEET

360 000 FEET

820 000 FEET

(Joins sheet 34)

(Joins sheet 38)

(Joins sheet 40)

(Joins sheet 45)

N

2 Miles

10 000 Feet

5 000

0

1 000

2000

3000

4000

5000

Scale 1:24 000

BORDEN COUNTY, TEXAS NO. 39

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

BORDEN COUNTY, TEXAS — SHEET NUMBER 40

(Joins sheet 35)

850 000 FEET

370 000 FEET

(Joins sheet 41)

(Joins sheet 39)

360 000 FEET

830 000 FEET

(Joins sheet 46)

N

Scale 1:24 000

2 Miles 1 0 10 000 Feet

1 5 000 0 5 000

¾ 4 000 ½ 3 000 ¼ 2 000 0 1 000

1 5 000 0 5 000

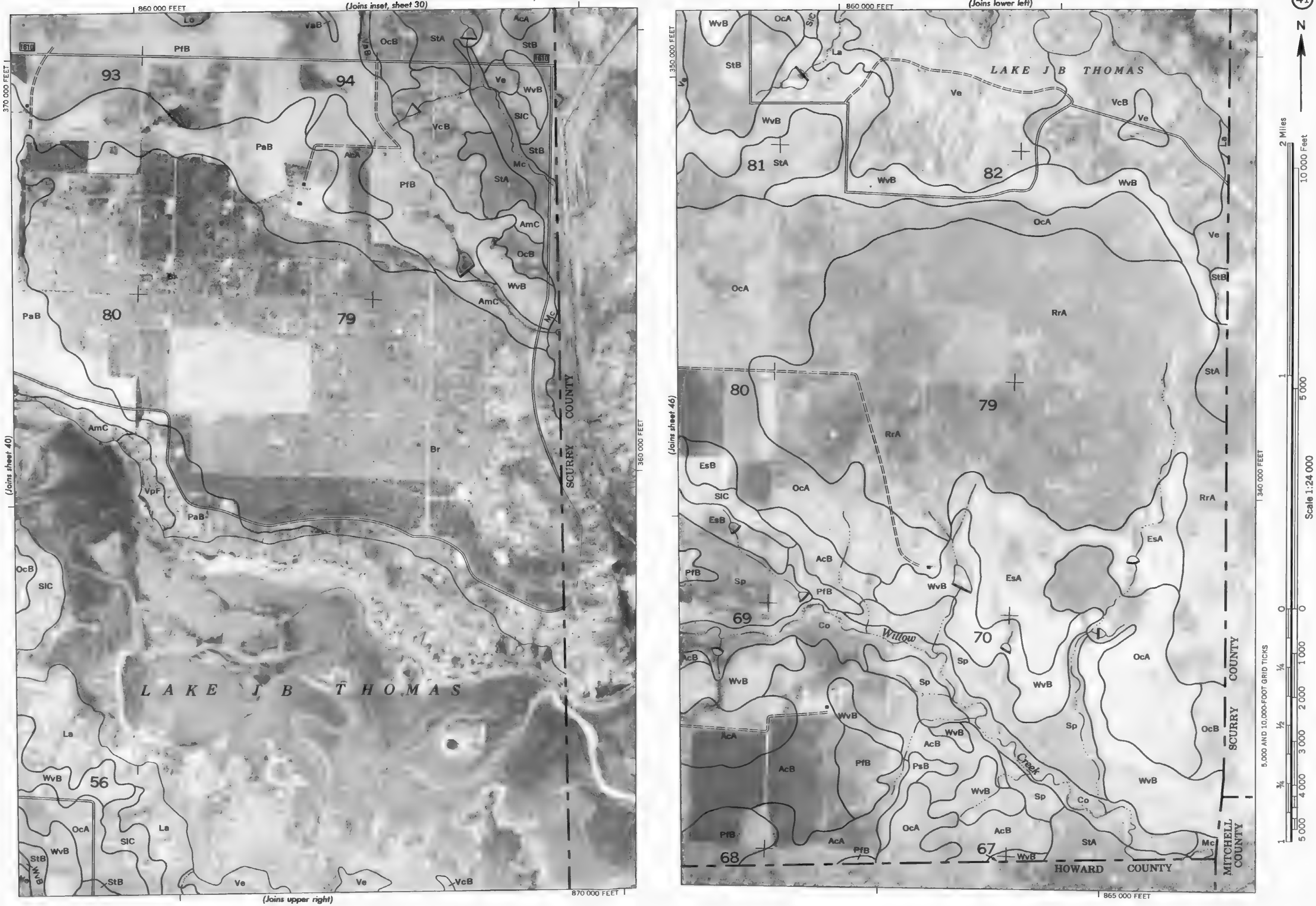
Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

BORDEN COUNTY, TEXAS NO. 41

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.



(Joins sheet 36)

730 000 FEET

N

2 Miles

10 000 Feet

Scale 1:24 000

5 000

0

1 000

2 000

3 000

4 000

5 000 FEET

1 000 0 1 000 2 000 3 000 4 000 5 000 FEET

340 000 FEET

350 000 FEET

710 000 FEET

(Joins sheet 43)

DAWSON COUNTY

HOWARD COUNTY

Co Creek

Plum Creek

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

BORDEN COUNTY, TEXAS — SHEET NUMBER 43

BORDEN COUNTY, TEXAS NO. 43

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

740 000 FEET

350 000 FEET

(Joins sheet 37)

(Joins sheet 42)

(Joins sheet 44)

HOWARD COUNTY

760 000 FEET

340 000 FEET

GRAVEL PIT

Plum Creek

43

N

Scale 1:24 000

2 Miles

10 000 Feet

BORDEN COUNTY, TEXAS — SHEET NUMBER 44

(Joins sheet 38)

790 000 FEET

350 000 FEET

(Joins sheet 43)

(Joins sheet 45)

340 000 FEET

770 000 FEET

HOWARD COUNTY

N

Scale 1:24 000

2 Miles 1 0 10 000 Feet 5 000 0

1 ¼ ½ ¾ 1 5 000 1 000 2 000 3 000 4 000 0

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

BORDEN COUNTY, TEXAS — SHEET NUMBER 45

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

(Joins sheet 44)
(Joins sheet 39)
(Joins sheet 46)

800 000 FEET
820 000 FEET
350 000 FEET
340 000 FEET

HOWARD COUNTY

45

N

2 Miles
10 000 Feet
5 000
1
Scale 1:24 000
0
1 000
¼
2 000
½
3 000
¾
4 000
5 000
1

BORDEN COUNTY, TEXAS — SHEET NUMBER 46

(46)

N

(Joins sheet 40)

850 000 FEET

350 000 FEET

(Joins sheet 45)

340 000 FEET

830 000 FEET

HOWARD COUNTY

(Joins inset, sheet 41)

Scale 1:24 000

2 Miles 1 0 10 000 Feet 5 000 0

1 ¾ ½ ¼ 0 5 000 4 000 3 000 2 000 1 000 0

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

BORDEN COUNTY, TEXAS NO. 46